

Scientific and Technical Information Policy Implementation Under OMB Circular A-130

Report of Agency Findings and Recommendations

May 1995

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Government Information Working Group
Information Policy Committee
Information Infrastructure Task Force

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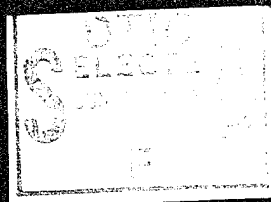
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1.0 EXECUTIVE SUMMARY

This analysis of OMB Circular A-130, as it applies to Scientific and Technical Information (STI), has served to validate the importance placed on information management by this administration. Each year billions of dollars are spent on research, monitoring, and data acquisition, resulting in information and knowledge that supports United States national security interests and can be used by business, industry, academia, and the citizenry. The Federal STI community has been entrusted with the management of the valuable resource that results. This six-month study shows that A-130 has been a useful tool in assisting these Federal managers with this responsibility and that the anticipated changes that information technology brings provide both opportunities and challenges.

As the section of the report on business practices shows, new techniques and better application of technology are enabling agencies to capture, catalogue, store, manipulate, analyze, and communicate ever-larger bodies of information and data to increasing numbers of users in a multitude of forms. A template of the Circular was developed as part of this study to help agencies identify good business practices; it is provided as an attachment to this report (Appendix B). The template is a useful tool to help focus attention on good management practices. As a result of this assessment by study participants, some advanced processes and systems were identified as being widely used by all agencies. These nearly limitless technological possibilities create a whole new set of information management challenges.

As a result of the application of the template to individual agency's information programs, the discussions of practices, and the review of A-130 policy, a few management challenges were identified. These challenges, discussed in the Issues and Recommendations section of this paper, derive from the practical experiences of STI managers. Whereas A-130, as revised, has attempted to address broader information concerns than the original Office of Information Resources Management (IRM) interpretation (e.g., hardware, software, form and format concerns), it became clear in our many discussions that still more can be done. If we are to realize a maximum return on our Federal investment in science and technology and the STI resulting, then we suggest a redefinition of life-cycle planning better suited to information content management which supports a wide variety of agency missions. The value of the information itself is measured differently by the various user constituencies. The existing guidelines are interpreted by providers and users

of Federal information still to be focused on systems, structure, and format. More clarity must be provided to eliminate any barriers to the interagency and public use of this national resource.

Clarifying guidelines concerning "restrictive practices" would also enable agencies to better ensure access to reliable, high-quality data and information. Agency mission and user needs must be the driving force in the way agency information management resources are deployed. If, for example, protection of information is necessary to ensure its integrity or to ensure that the United States will continue to receive foreign information, these protections should not be considered restrictive practices.

As funding diminishes and the information explosion continues, guidelines must make it clear that information resources must be leveraged, that shared standards be aggressively pursued, and that methods be constantly evaluated to determine how we can best meet our customer requirements.

In summary form, the recommendations arising from this study include:

- Clarify "life-cycle planning" for information usability.
- Develop guidelines to ensure information integrity for the public good.
- Clarify guidance concerning public access to agency information.
- Resolve conflicts between A-130 objectives and those of other Government initiatives.
- Sponsor an effort to develop a selected mode of operation for Government information services.
- Institutionalize interagency cooperative efforts for information sharing.

These recommendations are offered to help Federal agencies do a better job of managing the STI resources with which they are entrusted. Circular A-130 held up well to a thorough analysis. A continual review will be necessary just to keep up with the pace of changes in technology, management practices, and user needs. It is important that the Office of Management and Budget (OMB) continues to give these issues consideration and support Federal agencies as they strive to do better for the American taxpayer.

2.0 INTRODUCTION

OMB Circular A-130 defines national policy for managing Federal information resources and implements the Paperwork Reduction Act (44 U.S.C. Chapter 35). The proposed 1993 revision of the Circular expanded its guidance beyond information technology to integrate

and consolidate all aspects of Federal information policy. The current (July 25, 1994) revision does much to improve the guidance and include management of information throughout its life cycle. This life-cycle concept is analogous to that used in the management of information technologies and is meant to include all aspects of information management from initial planning through final disposition of the information (whether that final disposition is permanent retention in an active collection, retirement to archives, or destruction). The application of information technology to improve the cost-effectiveness of collection, management, and dissemination is another key item in the revised Circular.

While the Circular is viewed as a key step toward moving Federal information programs into the "information age," questions still remain regarding its implementation, especially in areas beyond "typical Federal information products." It is from this perspective that several Federal agencies, under the interagency group CENDI (Commerce, Energy, NASA, National Library of Medicine, and Defense Information), sought a dialogue with OMB regarding the implementation of OMB Circular A-130 for the management of Federally developed STI.

In August 1994, Bruce McConnell, Chief, Information Policy Branch, Office of Information and Regulatory Affairs, OMB, chartered the A-130 Implementation Group for Scientific and Technical Information (STI) under the auspices of the Government Information Working Group, Information Policy Committee, Information Infrastructure Task Force. The Group was to review the implementation of OMB Circular A-130 from an STI management perspective and to identify particularly good practices in the management of Federal STI. Furthermore, it was to review these processes with special regard for the impact of new information technologies and the national information infrastructure.

The result of this effort was to share experiences, identify noteworthy practices, and determine whether any additional implementation guidance would be useful in view of the characteristics of STI.

The Group membership consisted of senior level managers from fifteen Federal agencies (Appendix A). Elizabeth Buffum of the Department of Energy was asked to chair the Group. Secretariat support was provided by the CENDI Secretariat.

3.0 APPROACH

3.1 Scientific and Technical Information Definition

As part of the first meeting, the agency information managers prepared a working definition for scientific and technical information. The definition was developed to

provide a common understanding of the information being addressed by the Group. For the purpose of this paper:

Scientific and Technical Information (STI) derives primarily from research, development, and monitoring activities of scientists and engineers and individuals supporting their work. STI includes new theory and data obtained from experimentation, observation, or computation in the form of text, numeric data, images, charts, and graphs. It includes information derived from theory and data that may be further transformed, described, evaluated, synthesized, and recorded through stages of analysis. This includes information ranging from laboratory notebooks and preprints to formal publications and evaluated databases. It includes metadata that are needed to describe and identify data and data sources as well as data about methods and protocols used in the information gathering processes.

STI may be documented and communicated in print, micrographic, magnetic, optical, or other media to enhance its communication, usefulness, and value for a wide spectrum of users and uses. The knowledge that exists in experts and is exchanged through interpersonal communications is an important part of the STI system.

The STI definition has evolved as science and technology have become an increasingly important part of our everyday lives and of the governance of our nation. Society has become more dependent on science and technology. For example, as environmental restoration and protection has evolved into a national priority, policy information characterized by environmental impact statements, site remediation plans, national Environmental Policy Act documents, epidemiological documents, etc., is now viewed fully within the scope of information managed by the STI programs of science and technology agencies. Consideration of the national and international need to share successful clean-up and prevention technologies and processes clearly places the need to manage this type of information at a high priority level within the national STI system.

The definition identifies the complex nature of STI and the various form and formats used to collect and disseminate the information.

As agencies discussed individual implementation activities, areas for clarification were identified and champions were assigned to develop the issues in these areas and provide recommendations for guidance that would help improve Federal STI management practices.

3.2 Agency Implementation of the Circular

A "Template for Agency Implementation of OMB Circular A-130" was developed to help agencies identify and summarize their information activities as they relate to the implementation of the Circular. In addition, a list of corresponding questions was provided to help agencies clarify the items addressed in the Template (Appendix B). The Template and agency responses served to provide much of the documentation of current agency practices (Appendix C) and provided the data for the discussion and analysis of the Circular.

The template may be a useful tool for agencies to use to gauge their implementation of the Circular.

4.0 FEDERAL AGENCY APPROACHES TO STI MANAGEMENT

Federal research, development, monitoring, and observation programs are in response to national needs or agency requirements. The purpose of these activities, regardless of agency or activity, is to acquire knowledge by generating data and information that can be analyzed, synthesized, and integrated into what is already known. The major mechanism to convey this knowledge is the STI generated through contracts and research grants in support of Agency missions and initiatives as well as directly through agency research programs and mission activities. Managing (cataloging, storing, manipulating, analyzing, and communicating) this information is vital to the success of Federal science programs. Information dissemination and technology transfer are integral parts of these programs.

Planning for information management activities is done during the planning and budget processes. In this planning process, the requirements for management of the information content, as opposed to the management of technology and its acquisition, are handled differently in different agencies. In all agencies, however, information technology procurements and other such programs are included in agency-wide IRM budgets. Some agencies have central STI management programs to provide agency-wide STI policy and to coordinate centralized STI management activities. These STI programs have a content focus as well as a focus on information technology as support tools. In agencies with central STI management programs, the functions of these programs are frequently considered overhead functions when agency budgets are developed. In other agencies, information management and IRM responsibilities rest with the various funding program managers, and planning for these functions is (or should be) included in the science and technology program plans. Some agencies are working to integrate STI management activities into overall Agency planning initiatives.

Generally, Federal agencies are responsible for ensuring that STI resulting from Federally funded research and from the routine conduct of their missions is received and appropriately disseminated. (Research funded by Federal grants, where grantees are expected to publish directly in peer-reviewed open literature, is a notable and significant exception to this general statement.) Federal contracts and grants under which STI is generated or collected generally contain provisions to ensure that the knowledge developed is available to the Federal government to meet mission and national needs. The resultant information may be provided by the contractor or grant recipient to the public through conference presentations, publication in technical journals, or contract "deliverables" to the agency. These deliverables have traditionally been primarily in the form of documents; however, it is becoming common for databases and software to be deliverables to the government and the scientific community.

Some agencies have processes in place to track and monitor ongoing research to ensure that information products are collected. Control of Federally produced or acquired information is an important function because STI is increasingly being viewed by some as a commodity. Legislation in recent years, specifically that related to technology transfer, has recognized this fact and provided for increased control of certain types of STI.

Some agencies use the information as barter to trade with other nations. This provides the agency and its U.S. customers access to a broader collection of information than would have been possible solely through agency-sponsored programs. In addition to these channels for acquiring agency-funded STI and international information, partnerships have been established among Federal agencies to exchange information and to provide locator services from one agency to another. Through these exchanges, agencies are able to leverage the full breadth of Federally funded activities.

The information is provided to agencies and the public through a variety of mechanisms. As stated previously, the information may be communicated through scientific organizations or commercial publishers (including electronic announcement through commercial vendors). Information may also be available directly from agencies. It may be transferred as hard copy or microfiche, on magnetic tapes or diskettes, or via value-added commercial networks as well as over the Internet to accommodate various technological capabilities of the submitters and recipients and the needs of the agency.

Federal agencies then disseminate this information through a variety of means. The responsibility for dissemination lies with the agency program performing or monitoring the information-generating activity, with the agency's centralized STI management program, or with both. In general, the need exists to disseminate STI to a broader public to ensure agency accountability and allow others (e.g., educators and scientists) to benefit from the public investment. This responsibility is not always embraced by R&D managers and where possible is left up to central information programs. Efforts to reach this broader public are often deemed to be outside the responsibilities of science managers who may not appreciate—and who are generally not funded to address (or at least do not consider

that they are funded to address)—the uses of information beyond those originally foreseen as part of their science activities.

The existence of centralized STI management programs in some agencies has helped mitigate this problem. These STI programs generally have the responsibility of announcing and disseminating agency information beyond the original scientific community and providing liaison with other Federal and commercial information vendors. Agency dissemination of STI to the public is often made on a partial cost-recovery basis.

Secondary or unanticipated use of publicly available information (i.e., information not restricted by proprietary, privacy, or national security concerns) is also addressed by making Federal information available through what might be termed secondary dissemination. This secondary dissemination can take many forms but generally includes announcing the availability of the information through commercial vendors and central Federal distribution channels, such as the National Technical Information Service (NTIS) and the Federal Depository Library program. Some agencies have established home pages on the Internet to facilitate public access to existing electronic information systems and to notify the public of the types of information that are available.

Agencies are continually confronted with balancing the public's right to know against the requirement of the government to protect proprietary, privacy, and national security information. Agencies must also be sensitive to the requirement to preserve the integrity of their information while providing for wide dissemination. Therefore, agencies have established procedures to control the availability of certain statutorily protected STI. Such controls conform to laws, regulations, Executive Orders, international agreements, directives, and agency policy. Under these authorities, information may be withheld for a specified time or may be restricted until laws or regulations are changed.

Agencies must also comply with records management regulations. As with dissemination, some agencies that support research and development efforts focus on the completion of the research and do not devote resources or attention to the retention of the STI generated by the research after a project is completed. Because STI is useful for an unspecified length of time, a significant portion of the information is retained permanently. Many agencies have established programs and networks to ensure the continued availability of the information to support future research efforts and reduce duplication of research. Many agencies are seeking new records management policies that allow them to take advantage of the latest technologies.

Finally, many agencies are actively involved in the standards arena to facilitate the management and processing of electronic STI. Standards offer the potential for increased accessibility, timeliness, and completeness of information as the information is increasingly used and reused in a wide range of applications.

In regard to the specific requirements of the Circular, this study has demonstrated that Federal agencies have established a variety of STI-related programs and procedures to support the missions of their respective agencies, as well as address the requirements that pertain to STI, from generation through collection to dissemination. Some of these practices represent a long-standing commitment on behalf of the agencies to manage Federally funded STI efficiently and effectively. Other programs and initiatives reflect the changing technological environment and the increased challenge for Federal agencies to demonstrate improved service to the public with fewer resources. Examples of agency practices are discussed in the following section; details of these practices are presented in Appendix C.

5.0 HIGHLIGHTS OF AGENCIES' PRACTICES

Today we are in a shifting paradigm in the management of our information resources. We are moving from a paper-based to a digital world. The innovative practices of STI agencies all involve actively adopting the best in available technologies while ensuring that legacy systems and legacy users are supported and maintained until they can be moved into new ways of operation. STI agencies are often leaders in this regard because they tend to be technology adopters. The practices that are highlighted in the following paragraphs attempt to show how agencies are meeting the challenges of a changing environment while meeting the requirements set out by our Federal policies on the management of information resources.

5.1 Information Management Planning and Evaluation

When planning for information management, there must be increased recognition that changes in both the means of production and the means of access to information must be accommodated. In 1993, the Department of Energy reorganized the agency and reengineered an integrated approach to the Department's planning and management of STI. The management of STI was elevated to the senior official level. STI was included in the agency mission statement. Internal agency policy directives were issued that provided for the full life-cycle management of STI. Many responsibilities for STI were transferred from central authority to all departmental elements to incorporate STI objectives into their own levels of planning and performance measures. This was a response to the reality of changes in technology where publication and dissemination can be done in a distributed although controlled manner.

In a second case, the National Library of Medicine (NLM) has implemented a highly successful planning and budgeting process based on expert peer review input to the development of its Long Range Plan. More than 100 leaders in medicine and librarianship, including individuals from government, industry, and academia, provide input to the planning process. Their specific recommendations are put into the Library's Plan, which

is a living document and actually drives budget development and execution. NLM tracks progress through the cycle and makes modifications as experience is gained. Another aspect of NLM planning resulted from the National Performance Review (NPR). Under the NPR, NLM has been designated a reinvention laboratory. Through this project, NLM is reengineering and modernizing its information technology infrastructure. This process should ensure that management and technology frameworks will be used to closely link mission, information content, and information technology capabilities. As part of the test site project, NLM has established an internal project team and a management oversight group. Reviews will take place to ensure that information technology transitions take place without disrupting existing programs and services. This effort should be a model of how the IRM process works at an organizational level.

A third approach to planning is its implementation in a decentralized agency environment. In this approach, the program office takes the initiative and integrates its efforts upward through agency management processes. The Environmental Protection Agency (EPA) Environmental Monitoring and Assessment Program (EMAP), which is a major data producer with a variety of stakeholders from the general public to policymakers, is an example. EMAP has developed a five-year strategic planning process that systematically provides for input of stakeholders. It also uses a peer review process for the development of the plan. This program plan is coordinated upward with strategic planning efforts in other parts of the Agency, particularly the Office of IRM.

With a focus on systems planning and the advancement of new techniques and technologies, agencies often must enhance and redesign existing systems to take advantage of developments. The proliferation of off-the-shelf software can assist in this area, giving agencies access to a wide range of information management packages. The NTIS has undertaken a major modernization effort and, as part of this effort, has adopted the operating acquisition philosophy, "invent nothing." Rather, it is adapting what is commercially available and scalable. As part of this process, in order to determine the type of technology needed to apply to a function, NTIS has done private-sector benchmarking to determine what systems might best serve its needs.

During the past few years, an increased emphasis has been placed on evaluation and measurement as agencies' programs compete for limited dollars. At the Defense Technical Information Center (DTIC), performance measurement and evaluation is a structured, ongoing process and is included in DTIC's planning documents. Senior managers set and adjust programs based on past performance, current trends, and new technologies or processes. DTIC tracks internal measures in the production process and also measures customer satisfaction to gauge performance. Meetings are held regularly where performance against goals is discussed. The process for setting standards is being expanded to include benchmarking against the best in business. For the new technologies, such as World Wide Web servers and home pages, techniques for evaluation are being developed as guidelines on what models to follow and what examples to avoid. Although the results

do not yet provide specific measures, they attempt to focus on the most prominent characteristics to consider. Flexibility and response to rapid change have to be engineered into these evaluation tools.

5.2 Information Collection and Dissemination

One of the most common directions in STI practice resulting from new enabling technologies is the development of standards and systems to collect technical reports in electronic rather than traditional paper formats. Since most of these reports are created in electronic form, electronic collection could save resources and reduce burden by eliminating the need for printed publication. Much of this work is in the development stages, and there are varying approaches among agencies; however, there continues to be interagency information sharing, and the technologies are converging. DTIC is developing an Electronic Document Management System (EDMS) that will encompass total electronic document receipt, storage, retrieval, and dissemination. Initially, collection will continue to be in hard copy, and reports will be scanned, but this is a precursor to collection in electronic forms, including disks, CD-ROMs, or over the Internet. Once the reports are received, they will be processed electronically. DOE is also transitioning to collection and announcement of reports in a fully electronic environment. DOE is emphasizing the development and implementation of a Standard Generalized Markup Language (SGML) format to facilitate processing electronic document receipt and management. In this regard DOE is also taking an interagency lead through the CENDI Manager's Group in the promotion of SGML standards.

DOE also has developed collection practices on an international level that have served as a model for other agencies. DOE has moved from bilateral international exchange agreements to multilateral ones. This promotes economies of scale for all nations interested in a common technical mission (e.g., energy). As these arrangements have developed, nations have improved efficiency of common collection through the standardization of exchange formats and the increased use of new electronic technologies for transmitting input. The development of AGRICultural OnLine Access (AGRICOLA) by the National Agricultural Library (NAL) is similarly done in a multilateral way. NAL continues to upgrade the technology by which the system collects and disseminates information within the limitations of a diversity of national capabilities.

Quality assurance planning is a key element in improving collection efforts in numeric data programs. The Environmental Protection Agency's (EPA) EMAP program emphasizes the ISO 9000 standard as well as other quality assurance tools and techniques. EPA provides guidance to programs contributing data so that they can structure their approach to data collection and integration to be more cost-effective, less burdensome, and higher quality.

Finally, the National Science Foundation (NSF) has a program that is oriented toward reducing the data collection burden. NSF has implemented an experimental program called FastLane that uses advanced information technology to redesign the way NSF does business with the research, education, and related communities. Three of the most developed projects are servers that provide for electronic submission of administrative information related to proposals, allow principal investigators to receive current status of a pending proposal, and provide lists of recent awards. NSF is working with other agencies who are developing similar systems.

Another area in which agencies' practices particularly reflect new and innovative approaches is in information dissemination. As some of the front-end collection systems described previously become fully electronic, the electronic dissemination of information is a logical extension. As the corpus of electronic information grows, agencies continue to find ways to tap into the emerging National Information Infrastructure (NII). Agencies are making more types of information available through more media. A dominant theme in each agency's systems development is the use of the Internet and especially Web tools. At the same time, there is recognition of user technology limitations and the need to accommodate low-end as well as high-end environments; for example, the DTIC EDMS mentioned earlier will provide the capability to make any document instantly accessible in a variety of formats, including electronic and paper.

DTIC has become known within the Department of Defense (DoD) for its knowledge of Web application development. DTIC makes extensive use of Mosaic for disseminating information and is doing Mosaic implementations for various other DoD offices. This has helped to integrate and facilitate the dissemination of DoD information. DTIC has assisted the Office of the Secretary of Defense to create a unified starting point and approach to public access to DoD information on the Internet.

The National Oceanic and Atmospheric Administration (NOAA) has developed a new Satellite Active Archive (SAA) that enables users on the Internet to quickly search, browse, order, and receive satellite data. The SAA will continue to improve customer access through an expanded user help desk functionality, increased communication bandwidth, and state-of-the-art storage management to ensure quick response to queries and orders. NOAA will continue the SAA to the National Aeronautics and Space Administration (NASA) Mission to Planet Earth/Earth Observing System Data and Information System (EOSDIS) interoperability work, expand joint NOAA Line Office/USGS/NASA development in interoperability, and implement Federal standards for the data and information dictionary, data transfer, and data storage. SAA is a node on the Web.

NLM as a key player in the high-performance computing and communication initiative is taking full advantage of the Internet and NII. Internet users can reach many NLM services through elementary as well as the more sophisticated Internet tools. NLM is also

working with other agencies to make important medical information available to the public. The full text of clinical trials is just one example.

NASA has developed Internet tools that provide access to its *Selected Current Aerospace Notices*, an announcement serial that had previously been distributed in paper at much greater costs. Some of NASA's experiments are taking place in the field centers where technical report servers are making full text of reports available in a distributed network. Access to portions of the NASA STI Database is also available through this network, and the marriage of finding tools plus the full text is generating considerable user interest.

The National Agricultural Library will be making its AGRICOLA database available over the Internet in 1995. NAL has other Internet servers that link NAL resources with those of the rest of the world-wide agricultural community. Its Electronic Bulletin Board System provides communications services as well as electronic access to products and information about NAL services. NAL has enhanced electronic information dissemination considerably with respect to interlibrary loan services and electronic document delivery via the Internet.

NSF has developed a Science and Technology Information System (STIS) available through dial-up and the Internet that, through a common integrated set of menus, can provide users with a wide variety of information of interest, including abstracts of awards made, the *NSF Bulletin*, NSF press releases, NSF policies, the NSF directory, information on offices and programs, and specifics about proposal submission.

Agencies are developing gateways and pointers to information to lead the end user to other sources, and agencies continue to address the establishment and the requirements of the Government Information Locator Service (GILS). The Defense Gateway Information System, developed by DTIC, is an integrated service providing on-line access to a large number of commercial and government databases. NOAA has developed its Data Set Catalog, which is now in the Directory Interchange Format (DIF) and includes a more flexible search capability. It has output formats compatible with GILS. The NOAA Catalog contains more than 5000 DIF entries and 22,000 general environmental entries. There are several access paths to the system, including dial-in and various Internet tools. NLM has developed a client-server interface to its on-line catalogs, including those for monographs, audiovisuals, and serials. The NTIS FedWorld® system provides a single gateway to more than 130 Federal bulletin board systems as well as linkages to many other services on the Internet. At NASA, access to aerospace databases and the joint library holdings was made available through the Goddard Master Directory system.

As these electronic dissemination systems are developed, there is a focus on making these systems more usable for the customer. User-friendly (particularly graphical) interfaces are a high priority. There is also an emphasis on directories and networking using transparent (to the user) protocols to help users navigate to the information they need. GoldenGate is a graphical user interface developed by DTIC that uses a common command language to multiple databases. It includes extensive user help features.

5.3 Effectively Providing Information to the Public

The current climate with emphasis on the National Performance Review and customer-driven government has led to some innovative projects by STI programs to reach the public. A few have been noted in the previous section on dissemination. Some agencies are not only addressing this need but also identifying additional public needs and arriving at effective ways to fulfill them.

In 1994, NLM initiated a program to provide direct access to information on HIV/AIDS to the affected community. This information is free of charge. The initiative resulted from the planning process described previously. In addition to providing traditional library reference services, NAL has established specialized information centers to provide in-depth coverage of specific areas of interest to increase availability of agricultural information. These centers are staffed with subject experts. NAL has also established a customer survey process to ensure that services and resources best meet the needs of its customers, including the public.

NTIS has as its major mission the provision of government information to the public and has undertaken an initiative to work with the public (i.e., the Depository Library Program) in new electronic ways. Currently, NTIS provides a rolling 30-day window of the NTIS database to Depository Libraries through FedWorld®.

Consistent with its philosophy of making STI more readily available, DOE undertook a special public access program in 1994 to open declassified documents to the public. It has established an OpenNet database, available through the Internet or via dial-up, to make this information available.

5.4 Opportunities and Challenges

As can be noted by the innovations in agency practice over the past two years, there have been significant changes in the management of STI and increased opportunities for STI programs to improve agency information management practices. Some of the causes of these changes include the advances in information technology, the promotion of the Internet and the NII, the National Performance Review and its customer orientation, the problems of information overload exacerbated by these new technologies, and the increased recognition of information as a public resource. As these developments have opened opportunities, they have also put into focus some challenges to the effective management of STI in the context of A-130 implementation. In a few cases it was determined that the challenges can be met best with additional guidelines and clarifications of policy as they relate to the practical and specific circumstances of STI management. The following section defines the challenges that were identified and offers recommendations to OMB to help agencies meet those challenges.

6.0 ISSUES AND RECOMMENDATIONS

There is considerable debate within the STI community concerning whether scientific and technical information is different enough from other classes of government information to warrant separate policy guidance. An analysis of the challenges arising within the various Federal agencies in the implementation of the Circular suggested that the characteristics of STI require an enhanced emphasis on its usability. The sheer volume of scientific data now being generated greatly compounds these challenges. The ease of data production and manipulation combined with the myriad of hardware platforms, software systems, and standards and the rapid changes in information technology have resulted in an increasingly intractable problem. Study participants concurred that information management guidance should give at least an equal emphasis to information *content* as to information *systems* to ensure that usability issues are sufficiently addressed by agency planners. The specific implementation concerns discussed below generally have their genesis in this usability issue.

6.1 Information Life-Cycle Planning

OMB Circular Section 8.a.(1) calls for integrated life-cycle planning for information and outlines objectives for that planning process. This requirement has two areas of impact on the management of STI.

The first is the repeated theme in interagency STI discussions regarding the problem of dealing with an intangible resource such as STI in a tradition where management focus when dealing with "information resources" has been on hardware and software. The Circular's policy framework now emphasizes both content and technology under the information management heading; however, in the planning context, the bias toward information systems rather than *use* of the information still exists.

The term "life-cycle planning" has traditionally been associated closely with IRM. The IRM process, in turn, has been viewed as a technology management and procurement management system process. IRM planning, data calls, and reviews tend to focus on technology acquisition and not the system objectives—information utilization. Therefore the effort put into responding to data calls often results in less than effective representation of information content issues and is viewed by some STI programs as a burden that produces no useful results. The continued lack of appreciation of information content and application objectives results in an emphasis on using technologies to heighten availability not usability. The Circular's reporting requirements for data that are not, in fact, effectively integrated into IRM plans contribute to increased overhead for information programs.

Second, STI does not have the same "cradle-to-grave" life cycle that information systems exhibit; therefore the issues of planning for the life cycle of the *information* should be considered separate from planning for the life cycle of the information *records*. In many instances, STI has a permanent value. Its life cycle differs from that of many other types of information because STI continues to build on itself. Life-cycle planning for STI, then, includes the challenge of planning for the retention and use of STI, recognizing that the potential value or term of usefulness of the information often cannot be determined at the beginning of the information generation or acquisition process. The scientific method over time either confirms or negates the technical validity and value of specific information.

Problems in implementing full life-cycle management have been particularly exacerbated by the rapid advance of information technology. As STI is generated in, or converted to, electronic formats, the question of record copies of information becomes moot. Transfer of an electronic copy of STI to the National Archives and Records Administration (NARA) for archival purposes could be accomplished at any time because that act does not remove the information from the originating agency. Then the question of retention of information in an electronic system by the agency becomes a function of anticipated demand and system capacity, with the "less useful" information (however that is defined) being deleted as necessary to make room for new information. Models for this new paradigm in "records management" do not yet exist but are certainly needed.

As a related issue, evaluating the long-term value of scientific records is a substantial problem. These records require a special expertise to understand. NARA has contracted with the National Research Council to develop advice from the scientific community on tackling this problem. The report of this project is expected shortly and should form the basis for a broad-scale review of policies and practices.

The STI community further recognizes that some agencies have substantial legacy knowledge but do not have the means to make it useful. Making older material available is costly because of the technologies involved both in reproduction and in preservation. These legacy records often require conversion to new formats for archival purposes, a process that can make disposition of the information prohibitively expensive.

Finally, the sensitivity of scientific data with regard to health and environmental issues has made the situation of proper records disposition a challenging end game with regard to full life-cycle planning.

Recommendation: Clarify "life-cycle planning" for information usability.

The term "life-cycle planning" should be better defined to address planning for the *use* of the information in terms of its value for research and developmental efforts, as a basis for decisionmaking, and to ensure an adequate record of STI activities.

Agencies would be better able to undertake effective planning and management for information use if the Circular gave additional guidance to information content planning so that it is understood and to information systems planning so that the differences are clear. We propose that OMB develop guidelines and a model system addressing how information content and information systems planning can be integrated. Planning guidance should include specific information dissemination objectives and encourage cooperation of dissemination activities within agencies.

Because information technology should be considered a means to an end, that of increasing the usability of information, we strongly suggest that, although the IRM function is required by law, the IRM function as traditionally addressed be specifically evaluated under the Reinventing Government initiative to determine if it is still required in the same manner as before the dramatic shift in information management enabled by new technology occurred.

Finally, in order to ensure that agencies' STI is managed in a coherent, coordinated manner, we suggest that OMB establish policy for the advocacy of STI within Federal agencies.

6.2 Information Integrity and Authenticity

The Circular appears to encourage Federal agencies to proactively disseminate their information as broadly as possible. However, because of the nature of STI, the public good may be better served with controls over some types of information than with unrestricted reuse. This is particularly true where government data integrity and authenticity must be maintained to protect the public health, welfare, or national security (both military and economic). At one extreme, there is the need for protection from information terrorists who could purposefully contaminate government information with impunity. At the other, there is the possibility for simple ignorance of data issues that could cause injury.

Throughout the drafting of the Circular, the provision that would prohibit agencies from placing controls on redisseminated information has been most troublesome to those who provide information services where quality control is essential. It is argued that placing the decision whether to participate in an agency's quality control efforts with a commercial vendor redistributing government information might seriously jeopardize sensitive information products and services that are critical to the national health and welfare.

It is in the public interest, for example, for the Federal Government to ensure the integrity of its biomedical information products and services. This can be accomplished in part through appropriate quality control arrangements with other public or private data centers that redistribute an agency's data. The quality controls ensure that the data remain as accurate, complete, current, and accessible as the data created by and accessible directly

from the Federal agency. This includes timely correction of errors when they are discovered.

This issue is of particular concern to the National Library of Medicine. The Library is mandated by law to acquire the world's biomedical literature, to organize it by indexing and cataloging, and to make the resulting information widely available to health professionals. The Library takes great care to see that its collections are comprehensive, that the literature that is most important for the health professions is indexed, and that the databases it creates are as accurate, complete, and up-to-date as possible. A failure to maintain quality control could have catastrophic consequences; for example, one author abstract stated the dosage of an antineoplastic agent was *every day* for 28 days. The correct regimen was once *every* 28 days. In this instance, the Library discovered and, with consultation, rectified the discrepancy. In other cases, the corrections have had to be made after the data in the abstract were available on-line at NLM and by the licensees. About 12 such errors occur each year. For their part, the licensees agree to correct database records as required (for the drug dosage error cited, for example), to update their products regularly, and to develop effective retrieval software for searching their database products.

The following are case histories where NLM's licensing arrangements resulted in corrections to disseminated health information that have saved lives:

- A pharmacist called NLM to say that in his on-line search retrieval he found the following dosage error that he thought could cause death if followed. The abstract read "four 1000 mg/kg doses of both inipenem and cilastatin were infused intravenously over twenty to thirty minutes at six-hour intervals." Upon checking the text of the article, the Library staff noticed that it read four 1000 mg doses of both inipenem and cilastatin were infused intravenously over twenty to thirty minutes at six-hour intervals. The dosage level was independent of the weight of the patient. NLM contacted the journal editor and then corrected the abstract in the on-line database. The Library immediately notified all licensees that the reference should be corrected in their databases as well. NLM's agreement required that licensees provide timely announcement of significant errors and retractions.
- The following notice appeared six months after the original publication: "Throughout the text doses of 3000 Gy and 6000 Gy were listed as total doses for treatment of small cell lung cancer. Treatment by either 3000 Gy or 6000 Gy to any area of the body is not compatible with survival." The doses in the abstract and text were 100 times the required levels. The correction was made within hours and corrected references were sent to all NLM licensees.
- A comparison of three different regimens in the treatment of acute brucellosis stated in its abstract that one regimen consisted of "oral doxycycline 200 mg/day for 45 days plus im streptomycin 1 g/day for 14 days." The next issue of the journal corrected the regimen to "oral doxycycline 200 mg/day for 45 days plus im streptomycin 1 g/day for

21 days.” In a comparative study the exact length of the regimen was critical. NLM corrected the abstract and sent updated information to its licensees.

- Attorneys for Dr. Robert Slutsky wrote a journal editor to request that Slutsky’s paper, “The Effects of Beta Adrenergic Blockade on the Natural Progression of Myocardial Infarct Size and Compensatory Hypertrophy” be retracted. The editor provided the retraction which stated that the conclusions set forth in the paper were unreliable. NLM indexed the retracting letter and appended the original Slutsky article with a statement noting its retraction. The updated references were immediately sent to all licensees.
- A major NLM licensee replaced its retrieval software and, while reloading MEDLINE, discovered in many of the records old *Medical Subject Headings* (MeSH) terms that should have been updated. NLM staff assisted the licensee’s programmers in locating and correcting the source of the problem and ensured that the new headings were in the file. As a result, the licensee, NLM, and most importantly, the users benefitted.

An article from the *Journal of the American Medical Association*, authored by Dr. Michael DeBakey, a pioneer and world renown heart surgeon, addresses these same concerns.¹ Dr. DeBakey confirms that “NLM indexers have discovered and corrected discrepancies between dosage figures in the text and in the abstract—discrepancies that could result in serious harm to a patient, to say nothing of malpractice suits for physicians.” Dr. DeBakey further states that in the absence of licensing agreements, some

...contend that physicians and scientists will readily identify, and reject, any information service that offers a defective product. But discovery of such flaws takes time, and, until such discovery, physicians who assume that information derived from the NLM carries that institution’s legitimacy may innocently prescribe on the basis of information that is out-of-date or otherwise faulty. Thus patients might be adversely affected before the errors are recognized.

In addition to the obvious importance of database integrity to the Nation’s health and the value of license agreements to assist in ensuring this integrity, their value in meeting certain legal requirements is also apparent. Unfortunately, accuracy and integrity of reported findings in scientific research have been called into question in the past, and court-ordered corrections with respect to the published literature disseminated by the NLM are made possible under licensing arrangements.

Under the Circular, without statutory authority or clarifying guidelines, such essential arrangements are deemed “restrictive” and are prohibited unless initiated by a redisseminator who wishes to use an agency trademark. Appendix IV to A-130, Section 8.a.(7)

¹DeBakey, M.E. “What’s in a Name?” The Paperwork Reduction Act. *Journal of the American Medical Association*. May 9, 1990; v 263, n18, 2490-2491.

provides a general context and explanation of the policy statement and advises agencies that they may require appropriate integrity procedures from the redisseminators who wish to use the agency information product “trademark.” This is not sufficient protection for STI products critical to the public health or safety or to maintaining confidence in government information being used as input to a critical analytical process.

The information management community also has a special concern regarding the reuse and downloading of data without necessary metadata. Metadata are not limited to technical specifications such as record layouts and data element definitions, but information is also included that allows users to know the accuracy of the data and to judge their validity for their intended use. This information is vital to ensure that the data are properly understood and used.

Recommendation: Develop guidelines to ensure information integrity for the public good.

Agencies should not be prohibited exclusively from exerting some control over any organization that seeks to redistribute Federal STI. Guidelines should be developed on the basis of the unique requirements to protect the public health, welfare, or national security that may be generated by an agency’s STI. Under certain circumstances (for example, areas of health, safety, the environment, and the economy) it is in the public interest for agencies to require redisseminators—regardless of trademark use—to comply with appropriate procedures that ensure data integrity and authenticity.

6.3 Dissemination and Access

One of the characteristics of STI that suggests it requires additional consideration is the fact that it arises from a polarized organizational and cultural setting. At one pole is the culture of science and academia because much of the government’s STI is generated by scientists in the nation’s colleges, universities, and research institutes. Scientific and academic culture maintains an imperative in favor of the widest possible dissemination of information. At the other pole is the culture of national security and competitiveness because economic and military competitiveness today are closely tied to high technology and technical innovation. This culture maintains that there is a need for containment of some information to protect national security, proprietary interests, and/or privacy.

Managers of scientific programs usually serve their mission communities well through established information dissemination channels. This generally highly technical information is intended for and used by a narrow audience, but there is also an acknowledgment of the public’s right to know. Frequently, however, information management to fulfill this requirement is not seen as part of the science and technology process but rather as an overhead function. Therefore support for these programs by science as well as senior managers is often absent. Secondary dissemination to audiences not addressed by the

mission programs, if it is provided at all, is left to centralized agency information organizations in agencies where these programs exist or to organizations such as the NTIS which has as its mission the dissemination of government information to the public. For decades, the major Federal STI programs have deposited their agencies' unclassified information—scientific, technical, and engineering publications—with NTIS; now, with the passage of the American Technology Preeminence Act making such deposits a legal requirement, other Federal agencies are doing likewise.

At the same time, advances in information technology coupled with changing Federal priorities have raised public expectations for access to government information. In some cases, program managers have attempted to respond by expanding their "outreach" to a broader customer base consistent with their program missions. This has been done through creation of special outreach programs to actively provide information and data to specific user segments. Planning for such dissemination programs often occurs after the information or information products have been developed rather than during the planning stage and often does not include the STI managers. The planning processes also may not be coordinated. The situation may have improved access to information in some cases but has created an inefficient and costly overall approach to disseminating Federal STI. In this environment, there is a need to have more active participation in planning for dissemination of the resultant information by the funding program and better coordination within and between agencies to leverage systems developed to serve specific customer segments.

The issue remains, however, regarding how much of an agency's resources should be expended on making information available to others when the primary intent of the information is to serve citizens by accomplishing the governmental functions for which the information organization is funded. Put in other terms, how to establish a balance between mission appropriations being used for mission activities and those being diverted to fulfill non-mission essential requests for information needs to be better understood. Models would be useful.

Recommendation: Clarify guidance concerning public access to agency information.

OMB's intent in the Circular regarding the extent to which agencies are to provide access to STI to all citizens should be clarified. Scientists and other technical individuals form the primary audience for the STI. Currently, agencies focus on particular customer segments proactively and address the needs of the general public by making information available on demand. The Circular does not clearly define whether "announcement" of the existence of information is sufficient for compliance or whether agencies must actively promote and deliver full text of the information. The public's right to the information should still be preserved; however, the extent to which agencies should or must reach out to the general public should be clarified so that agencies can allocate scarce resources most effectively.

6.4 Balancing A-130 and Other National and International STI Requirements

Circular A-130, Section 8.a.(7)(a) states that "Agencies shall ... avoid establishing or permitting others to establish on their behalf, exclusive, restricted, or other distribution arrangements that interfere with the availability of information dissemination products on a timely and equitable basis." Safeguards limiting the collection and sharing of information, as set out in Section 8.a.(9), apply only to information concerning individuals. In practice, international exchange of information, cooperative partnerships, and technology transfer activities require that applicable STI be protected under certain circumstances. Agencies face the challenge of aligning A-130 policies with the realities of operating these various programs, which are also affected by other policy and legislation.

STI is international in scope, not regarding national boundaries. One consequence of its international nature is that STI policy is to a considerable extent intermixed with and affected by foreign policy. What is critical about the characteristics of STI in today's environment is that it is increasingly being viewed as a commodity which has value that can be translated into military and economic competitiveness. The importance of understanding this value increases in relation to the international issue of protecting information through restrictions.

The prohibition on Federal agencies restricting reuse of information weakens Federal agencies' ability to deal with international partners. Agencies must be able to honor restrictions requested by exchange partners and to pass these restrictions on to the other parties. Certain countries are willing to provide U.S. agencies with information provided certain redistribution criteria are honored. In such cases, agency officials might legitimately determine that the value of the information in question to the U.S. Government (and the public it serves) is sufficiently great that it is in the U.S. Government's interest to accept the conditions imposed by the foreign government.

NASA is experiencing serious problems in this area as a result of the prohibition in A-130 against agencies "establishing or permitting others to establish on their behalf, exclusive, restricted, or other distribution arrangements..." with regard to information dissemination products. NASA has established exchange agreements with international partners for the purpose of obtaining international aerospace-related STI for the use of NASA scientists and engineers and the U.S. aerospace community. In exchange, NASA provides its STI to the international partners. Under the Freedom of Information Act, a private-sector company has been obtaining from NASA material received from NASA's foreign partners and has been marketing it worldwide, including in the countries in which the data originated. NASA's international partners object strongly to this practice because they see their data as proprietary and protected by copyright.

NASA's inability to protect the international data may eventually seriously harm U.S. aerospace. It is not sufficient to consider copyright assertion a legal remedy for this

problem because of the difficulties a foreign partner would have litigating copyright infringement suits through U.S. courts. As foreign partners become increasingly reluctant to provide their STI to NASA through exchange agreements (because their data are then marketed back to them by U.S. companies), the data will become harder for NASA scientists and engineers to obtain. Just as other nations go to great lengths to obtain international STI (especially U.S. STI) to benefit their industries, the U.S. needs to take some care to ensure continued access to international data for our own aerospace scientists and engineers if we hope to maintain a competitive position in this area of traditional U.S. strength. This no doubt applies as well to other areas where the U.S. is facing vigorous international competition characterized by major industrial or technical data-gathering efforts.

The area of environmental information faces similar problems. The Office of Science and Technology Policy's Committee on Environment and Natural Resources and Committee on International Science, Engineering and Technology have jointly established an inter-agency Working Group, chaired by James Baker of NOAA, to address the exchange of international environmental data and related products. We would invite OMB to consider the issues being raised by that group as well.

The Working Group began its work in December to develop a U.S. position on the proposed World Meteorological Organization (WMO) international data exchange resolution, review national data policies and other relevant international agreements involving the exchange of environmental data, and develop U.S. guidelines for cooperation with countries and organizations with policies that restrict the use or dissemination of environmental data. The Working Group is expected to have the U.S. position, as it relates to the proposed WMO policy, developed by late May 1995.

The Circular is silent on Federal agency management of information in an international context and, in particular, international information or information from international collaborative activities. It does include, under Basic Considerations and Assumptions, the general statement that Federal information policies can affect, and be affected by, policies and activities of other nations (Section 7.m.). It provides no specific policy regarding handling or disseminating international information received on exchange, particularly when this information comes with certain restrictions. If information acquired from and produced in conjunction with international partners is included in Federal information products, then this international information falls within the scope of the Circular. Currently, only treaty-level exchange agreements with international partners take precedence over policy. Therefore agencies have difficulties determining a reasonable course of action concerning use of this non-U.S. data.

Domestically, the U.S. Government has a set of laws and policies pertaining to the transfer of Federal technology to private industry. These laws and policies apply directly to STI. Technology transfer is a means for getting Federally generated technology and expertise to the business community where it can be developed, commercialized, and

made use of by the general public. The Federal statutes (codified in Title 15, Section 3701–3715, Executive Order 12595, and several other statutory provisions) recognize that STI and associated trade secrets and commercial and financial information have explicit and implicit value that can be exploited in the marketplace. Much of this information is from both government and non-government resources. As such, the use of the information is licensed for government-purpose (internal use) rights and commercial rights. Technology transfer laws and policies seem to conflict with some A-130 policies.

Cooperative Research and Development Agreements (CRADAs) and other types of partnership arrangements between the Federal Government and the private sector include provisions for limiting dissemination of STI produced through these arrangements for a period of time in order to protect the intellectual property rights accruing to the private-sector partners and to allow these partners to exploit the commercial value of their work before that information is made generally available. As with the provisions of technology transfer agreements, these partnership arrangements may conflict with A-130 policies concerning the timely dissemination of government information.

The electronic Freedom of Information Act has the potential to complicate this existing situation further. Expanding the jurisdiction of the Freedom of Information Act to electronic information without careful consideration of the difference between paper and electronic records is problematic. As an example, a commercial vendor would have a license to search through agency locators and identify commercially exploitable databases irrespective of the agreements made by the U.S. Government to acquire portions of the database from domestic or international partners. If vendors then seek to use the information for purposes outside the agreements through which database contents were originally compiled, opportunities for exchanges or partnerships may be compromised because the government may be seen as being unable to live up to its agreements concerning the protection of STI, even for a limited, set period of time. The Freedom of Information Act was intended to promote openness in democratic government rather than to serve as the basis for commercialization of Government information (note, particularly, foreign equality under the Freedom of Information Act). Many believe that, before an electronic Freedom of Information Act is passed, the nation needs a thorough debate on the Act's foundations as a means of balancing openness in government against commercial interests.

Recommendation: Resolve conflicts between A-130 objectives and those of other Government initiatives.

It is in the interest of the U.S. Government and the taxpayers to exempt certain international STI from the A-130 reuse provision, especially when unrestricted reuse threatens to cut off the supply of the information. Likewise, A-130 needs to be interpreted in a way that does not undermine other important goals, such as national economic competitiveness. Therefore some provision should be made under A-130 or through clarification of appropriate sections to allow STI to be selectively exempted from the

policy requiring "timely and equitable" dissemination if provisions of domestic or international agreements call for withholding of the information. Barring that, additional guidance should be provided to agencies concerning resolution of these apparent conflicts of objectives between A-130 and Federal programs, such as international cooperation and technology transfer.

6.5 Need for Uniform Approaches to Information Access and Content

The Circular provides for improved public access to government information through the use of electronic means; however, this has made it more difficult to locate the information sought among the increasing number of options available. Navigation through the variety of existing agency solutions to information access is problematic. The government serves many publics, and these publics have various levels of electronic access capabilities.

Government STI has no standard "look and feel." Duplicative systems have been developed to serve similar or individual customer groups. Furthermore, no standards for data quality have been developed, a problem that is compounded in the electronic environment. The Federal Government needs to provide a cohesive electronic image to its many publics and provide them with a "selected mode of operation."

The Circular indicates that voluntary and Federal information processing standards should be followed whenever possible. The issues remain, though, of how to plan for and implement these standards (i.e., how to determine which standards exist and which to use, how to find out what standards are being developed, and how to ensure that standards can be developed and agreed upon by appropriate standards-setting bodies in a timely manner) given the rapid pace of technology change.

At present, a myriad of resources are accessible through ftp, gopher, and World Wide Web (WWW). Within these tools, particularly in the WWW, there exists a great variety of ways and "modes of operation" to describe a set of resources, to find a particular agency, or to find a specific record in some obscure database at a remote field station.

As electronic publishing becomes ever-more ubiquitous and the WWW allows everyone to be an instant electronic publisher, the questions of agency standards for publishing and disseminating STI on the net become significant. Federal Information Processing Standards (FIPS), National Information Standards Organization (NISO), or the Internet Engineering Task Force (IETF) do not yet address these concerns sufficiently.

One specific standard that will be the key to rationalizing finding tools on networks, such as Government Information Locator System (GILS), is the standardization of Uniform Resource Locators (URLs) and Uniform Resource Names (URNs). Today, agencies follow a standard for report numbers, International Standard Serial Numbers (ISSNs), etc., which are the print publication analog. It is important to begin to figure out how to standardize

and manage electronic document identifiers. It is a fundamental tool for achieving success at making Government information products findable and available.

Recommendation: Sponsor an effort to develop a selected mode of operation for Government information services.

Developing uniform approaches to information content warrants attention equal to that given developing standards for structure and format. In order to address this set of issues and bring some order out of increasingly chaotic conditions, OMB should initiate and provide support for an effort to develop uniform (a selected mode of operation) approaches to home pages or other access to agencies' information resources and services and a uniform package for organization, presentation, and retrieval of Government information resources. The STI communities represented by the members of this task force should function as the developmental focus for the initial effort on the premise that (a) STI represents a broad range of data types for organization, presentation, and searching/retrieval; and (b) the STI user public represents a more manageable subset of the general public but could provide the necessary feedback to address issues of scalability.

6.6 Interagency Information Sharing

The Circular addresses information sharing primarily from the standpoint of paperwork reduction, urging agencies to look to satisfying new information needs through inter-agency or intergovernmental sharing. Intra-agency or interagency use of sharing of government information is specifically excluded from the definition of the term "dissemination" (see OMB A-130 Section 6.c.). Sharing of information systems, not information content, is a policy requirement "...to the extent practicable and legally permissible." There are significant benefits to sharing STI. STI is an integral part of science and its effective management and use play a vital role both in research and policy decisions. STI is both input to and a result of the government's research and operational, mission-oriented enterprises. The exchange of information and the sharing of ideas make a critical contribution to scientific advancement and improve research and development (R&D) productivity. Scientists and engineers involved in R&D spend 40 to 60 percent of their time on information-related activities.

Interagency sharing efforts now being done are normally ad hoc and done within a discipline or specific program area. CENDI, for example, is a voluntary organization addressing items of common interest to its member agencies. It is increasingly apparent, however, that R&D, the monitoring of the nation's environment, and other research enterprises are multidisciplinary and require interagency cooperation. No policy exists to bring together the collective experience of agencies to formulate some general guidelines. STI is a resource, access to which is required to improve the accomplishment of the functions of government units, both individually and in cooperation with others. Without

Federal policy addressing this need, however, Federal agencies may continue to look inward and not commit the resources needed to enhance STI sharing.

Recommendation: Institutionalize interagency cooperative efforts for information sharing.

Provision should be made under appropriate sections of A-130 to promulgate the sharing of STI among government organizations. Interagency cooperative efforts such as CENDI should be officially encouraged and institutionalized as is the case with the Federal Geographic Data Committee.

APPENDIX A

GROUP MEMBERSHIP AGENCIES PARTICIPATING IN THE STI A-130 IMPLEMENTATION GROUP

AGENCY	ORGANIZATION	PARTICIPANTS
Department of Energy	Office of Scientific and Technical Information	Elizabeth Buffum, Chair Barbara Bauldock* Mark Fornwall Judy Gilmore
Department of Agriculture	National Agriculture Library	Richard Thompson
Department of Commerce	National Technical Information Service National Institute of Standards and Technology National Oceanic & Atmospheric Administration	Donald Corrigan Paul Vassallo Marvin Bond Greg Withee William Turnbull Christopher Miller Linda Moodie Ernest Daddio
Department of Defense	Defense Technical Information Center	Kurt Molholm Betsy Fox
Department of the Interior	U.S. Geological Survey	Eliot Christian
Environmental Protection Agency	Environmental Monitoring and Assessment Program	Robert Shepanek Clifford Moore
National Aeronautics and Space Administration	Scientific and Technical Information Program	Sylvia Kraemer Barbara Bauldock* Terese Ohnsorg
National Archives and Records Administration	Center for Electronic Records	Ken Thibodeau

*Changed jobs and agencies during the study period.

National Institutes of Health	National Library of Medicine	Kent Smith Elliot Siegel Sally Burke
National Science Foundation	Information and Dissemination Branch	Judy Hunter Gail McHenry
U.S. Air Force	National Air Intelligence Center	Thomas Pedtke
White House Executive Offices	Office of Science and Technology Policy Office of Management and Budget	Robert Bonometti Bruce McConnell Jasmeet Seehra Peter Weiss
CENDI	Secretariat	Bonnie Carroll

APPENDIX B

TEMPLATE FOR AGENCY IMPLEMENTATION OF OMB CIRCULAR A-130

PRIMARY REQUIREMENT AREAS

I. INFORMATION MANAGEMENT REQUIREMENTS

1. Information Management Planning

- STI planning should be life-cycle planning and integrated with Agency planning and budgeting processes.
- Plans should consider the form of the information, its content, customers, use, and levels of required protection.
- Managed STI should have practical utility.

2. Information Collection

- STI collection and creation activities should support the Agency's functions and minimize burden.

3. Electronic Information Collection

- STI collection techniques should be reviewed against recommended criteria pertaining to volume, audience, frequency, changes to structure, and conversion considerations.

4. Records Management

- Agency records management programs should properly account for STI and should comply with National Archives and Records Administration (NARA) requirements.
- Agency employees with responsibility for STI management should receive appropriate training.

5. Providing Information to the Public

- Agencies should help the public locate government information.
- STI provided to the public should be consistent with the Agency missions.
- Maximizing the usefulness of the information should be balanced with minimizing the cost.

6. Information Dissemination Management System

- Dissemination should be timely and take advantage of all dissemination channels.
- Agencies should have a management system for all STI dissemination products that addresses user needs, interaction with depository libraries, actual and potential sources of STI, and ensures compliance with A-130.
- An inventory of all agency STI dissemination products should be maintained.

7. Avoiding Improperly Restrictive Practices

- Distribution practices should be reviewed in regard to timeliness and equity of use and reuse, resale, or redissemination.
- User charges should be set at the cost of STI dissemination and special arrangements and/or exceptions to the charging structure should be identified.

8. Electronic Information Dissemination

- Electronic media and formats, as well as public networks, should be used as appropriate to increase accessibility and usefulness.
- Electronic dissemination should not impose substantial acquisition or training costs on users.

9. Safeguards

- Agencies should determine and fully implement appropriate protection for STI and ensure compliance with applicable limitations.

II. INFORMATION SYSTEMS AND INFORMATION TECHNOLOGY MANAGEMENT

1. Evaluation and Performance Measurement

- Work process redesign and application of information technology should be utilized to improve effectiveness and efficiency of STI operations.
- Life-cycle benefit-cost analyses should be established for each information system supporting STI in accordance with OMB guidelines.

2. Strategic Information Resources Management (IRM) Planning

- IRM planning, which incorporates STI, should promote fulfillment of Agency's mission.
- Planning should address requirements of 5 CFR 1320 and 44 USC 3506 regarding information collection burden and preparation of a five-year plan, respectively.

3. Information Systems Management Oversight

- Management and technology frameworks should exist for documenting linkages between missions, needs, information content, and information technology capabilities.

4. Use of Information Resources

- Ensure STI systems support Agency's requirements.

5. Acquisition of Information Technology

- Full and open competition in the acquisition of information technology should be practiced, off-the-shelf software should be incorporated as an agency policy when cost-effective, and conformance to OMB Circular A-109 should be ensured.
- Acquisition of information technology procedures should consider individuals with disabilities.

SPECIFIC AGENCY RESPONSIBILITIES

I. INFORMATION MANAGEMENT REQUIREMENTS

1. Information Management Planning

Does the agency have an integrated life-cycle information management planning system in place for STI?

Are the phases of the STI life-cycle viewed in their relationship and impact on one another?

Is the impact on dissemination processes and goals well-articulated?

What mechanisms are in place to determine the effects of agency STI management actions on members of the public? To ensure consultation with the public?

What are the mechanisms used for interagency STI cooperation to avoid unnecessary duplication of effort? Intergovernmental? Commercial?

Is the STI management planning system linked into the planning for information technology and information systems development? How?

What kind of training is done to ensure employees have appropriate skills to manage STI?

How is a determination made regarding the level and methods of protection of government STI? How is risk measured to ensure protection is commensurate with risk?

Is there an agency policy regarding use of voluntary and Federal Information Processing Standard (FIPS) standards for STI? Where is it documented?

How are privacy rights handled with regard to STI? What are the systems of legal and technical safeguards?

What is the agency's system of documentation of programs to ensure management accountability for STI?

Are records management and archival responsibilities an integrated part of the STI systems development?

How is public access to STI records provided?

2. Information Collection

Can the STI collection and creation activities be justified as part of the proper performance of agency functions?

Does the STI managed have practical utility?

3. Electronic Information Collection

Are electronic collection techniques used in STI? Indicate which and how each of the following apply to STI management in your agency:

- A large volume of data is collected?
- The information reaches a large proportion of the public?
- The information collection recurs frequently?
- The structure, format, or definition does not change over time?
- Routine conversion of the information is made to electronic format?
- Substantial proportion of the public is known to have ready access to technology and to maintain the information in electronic form?
- Conversion to electronic reporting of STI, if mandatory, will not impose substantial costs or adverse impacts on public, especially State and local government and small business entities.

4. Records Management

Do agency records management programs properly account for STI?

Are STI records available regardless of form or medium?

Are STI retention schedules approved by NARA for your agency?

Is there adequate training of employees and contractors regarding STI records management responsibilities?

5. Providing Information to the Public

What are the requirements to disseminate STI within your agency mission?

Are the requirements being successfully met? How?

Is the STI organization, activities, programs, meetings, systems of records and other information holdings provided to the public for access? How?

How are the Freedom of Information Act (FOIA) and Privacy Act implemented with regard to STI in your agency?

How are each of the following considerations taken into account in your STI dissemination planning?

- Balance between maximizing usefulness and minimizing the cost to the government and public of STI dissemination?
- Assurance of equity and timeliness of STI dissemination?
- Utilizing all dissemination channels in discharging dissemination responsibilities?
Specifically:
 - Federal
 - State and local governments
 - libraries
 - private sector entities
- Aids to help the public in the location of STI maintained by your agency?

6. Information Dissemination Management System

Does the agency have a management system for all STI dissemination products?
Please describe.

How does the dissemination management system assure that STI dissemination products are necessary for the proper performance of agency functions?

How does the Agency determine if an STI product from another Federal or nonfederal source could reasonably fulfill its dissemination responsibilities?

Does the agency have an inventory of all agency STI dissemination products?

Does the agency provide aids, such as catalogs and directories, to help locate agency STI dissemination products?

If STI products come from another agency, is this other source of information identified in the product?

How does the agency assure that the public with disabilities whom the agency has a responsibility to inform has reasonable access to STI dissemination products?

How are the agency STI publications made available to the depository libraries?

Which electronic STI dissemination products are made available to the Government Printing Office (GPO) for distribution to depository libraries?

How does the agency communicate with the public and State and local governments to ensure that STI dissemination products meet their needs?

What procedures are used to provide notice when initiating, modifying, or terminating significant STI products?

What plan and/or procedures have been put in place to ensure that all STI dissemination policies and practices are in compliance with the requirements of this Circular?

7. Avoiding Improperly Restrictive Practices

Does the agency have any exclusive, restricted, or other distribution arrangements that do not permit timely and equitable availability to STI dissemination products?

Does the agency have any restrictions on the reuse, resale, or redissemination of STI dissemination products by the public? Are any fees or royalties charged?

Are user charges set at the cost of STI dissemination and no higher? How are these costs calculated?

- Does the agency have a statutory requirement that differs from the above policy?
- Are special STI efforts carried out for the benefit of a specific identifiable group beyond the benefit to the general public? How is this STI charged for?
- Are any charges less than the cost of dissemination? What is the justification for this?

- Does the agency have any exceptions to this charging policy that are approved by OMB?

8. Electronic Information Dissemination

To what extent does the agency use electronic media and formats for STI?

Is agency STI developed and maintained electronically?

Are large, highly detailed volumes of STI provided to the public? Is electronic media the format of choice? Why?

Are STI products disseminated frequently?

Does your agency's electronic STI dissemination impose substantial acquisition or training costs on users? How about State and local governments? Small business entities?

9. Safeguards

How does the agency determine proper level of protection for STI to minimize risk from loss, misuse, or unauthorized access or modification?

How does the agency limit collection of STI that identifies individuals to that which is necessary for the proper performance of agency functions?

How does the agency limit sharing of STI that contains proprietary or personal information to that which is legally authorized? How does the agency ensure confidentiality of the STI?

Does the agency have Privacy Act STI? How is that information provided to individuals consistent with Privacy Act provision?

II. INFORMATION SYSTEMS AND INFORMATION TECHNOLOGY MANAGEMENT

1. Evaluation and Performance Measurement

Is your agency carrying out any work process redesign or application of information technology to improve effectiveness and efficiency of STI operations?

Does your agency have life-cycle benefit-cost analyses done for each information system supporting STI?

- How much detail is each analysis relative to size of investment? How is responsibility for this determined?
- Are the benefit-cost analyses consistent with OMB A-94 guidelines?
- Do the benefit-cost analyses rely on systematic measures of mission performance? Which of the following are considered and how are they measured?
 - Effectiveness of program delivery
 - Efficiency of program administration
 - Reduction in burden on the public
- Are benefit-cost analyses undertaken for major information systems supporting STI on an agency-wide basis as part of ongoing management oversight processes? Describe the processes used.
- Is there a process of post-implementation reviews of information systems supporting STI to validate benefits and document effective management practices? Are lessons learned conveyed for broader use?

2. Strategic Information Resources Management (IRM) Planning

Does your agency have a strategic information resources management planning process that includes STI?

Does this process address how the management of information resources promotes the fulfillment of the agency's mission? Is STI included in this process? Is STI included in the agency's IRM plan and does the coverage of STI reflect and anticipate changes in agency mission, policy, technological capability, or resource levels?

Is STI included in the planning and budgeting for the information collection burden imposed on the public as defined by 5 CFR 1320?

Is operational information technology planning linked to anticipated STI and mission needs? Are STI needs reflected in the up-to-date, five-year plan as required by 44 USC 3506?

- Are existing and planned major information systems for STI reflected in this plan?
- Are planned information technology acquisitions for STI included?
- Do the major information systems and planning information technology acquisition relate to each other and support the achievement of the STI mission?

- Are STI requirements included in computer security planning?

Is planning for information systems for STI coordinated with other agency planning processes including strategic, human resources, and financial resources?

3. Information Systems Management Oversight

How does the agency ensure that each information system in support of STI meets agency mission requirements?

Is there agency periodic review of information systems supporting STI to determine if mission requirements have changed?

- To determine whether the information system continues to fulfill and anticipates mission requirements?
- To determine what level of maintenance is needed to ensure the system operates cost-effectively to meet mission requirements?

How does the agency ensure that the official responsible for administering an STI program supported by an information system is responsible and accountable for management of that system throughout its life cycle?

What training is provided for the users of Federal information resources that support STI?

How are the prerogatives of State, local, and tribal governments vis-à-vis systems supporting STI protected from undue restrictions?

How is decisionmaking about information, human, financial, and other supporting resources coordinated so that systems proceed in a timely fashion toward milestones in the life cycle and deliver intended benefits? Is there an agency-wide management or IRM committee? Is STI represented?

Is the financial management system supporting STI in conformance with OMB Circular A-127?

4. Use of Information Resources

Describe your agency's management and technical framework for using information resources that document linkages between STI mission needs, information content, and information technology capabilities.

- What are the parameters (e.g., technical standards) of the framework?

How does your agency ensure that information systems supporting STI are developed in a manner that facilitates necessary interoperability, application portability, and scalability of computerized application across networks of heterogeneous components?

How does the agency ensure that unnecessarily duplicative information systems development is avoided?

- From within the agency?
- With other agencies?
- With the private sector?

What mechanisms are in place to share available information systems supporting STI with other agencies?

How are intra-agency and interagency sharing of information technology opportunities identified? Is sharing occurring in your agency?

Do any STI organizations manage Information Processing Service Organizations? If so, do you account for full costs of operation?

- Do you recover costs from all service recipients on an equitable basis?
- How do you document sharing agreements?

How is the security level established for information systems supporting STI? Are levels commensurate with the risk and harm that could result from loss, misuse, or unauthorized access or modification to information in the systems?

5. Acquisition of Information Technology

Does your agency use full and open competition for acquisition of information technology?

Is it agency policy to use off-the-shelf software? Are methods of justification clear to develop custom software?

Are procedures in place to ensure conformance to OMB Circular A-109?

How are individuals with disabilities needs taken into consideration in the acquisition of information technology?

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APPENDIX C

AGENCIES' STI-RELATED PRACTICES AS THEY RELATE TO OMB CIRCULAR A-130 REQUIREMENTS

The following discussion is not presented as a comprehensive inventory but, rather, to highlight some examples of effective implementation of requirements of OMB Circular A-130.

A. Implementation of Information Management Planning

The Department of Energy (DOE) has made important advances in recognizing the value of scientific and technical information (STI) as a Departmental resource. A 1993 reorganization of the Department elevated the management of STI to the senior official level. Stewardship of STI was also included as part of the Department's mission statement.

The DOE Directive devoted to Scientific and Technical Information Management was revised and streamlined in 1994 to address the primary requirements presented in A-130. The overall purpose of the Directive is to "establish Department of Energy policy and requirements to ensure the integration of scientific and technical information management into Departmental programs and activities."

It is currently Departmental policy that

"Departmental programs funding the creation of scientific and technical information must follow life-cycle information management practices to ensure that the information is planned for, budgeted, produced, processed, disseminated, and stored in cost-effective ways to ensure its maximum utilization by all customer segments including U.S. industry and the general public."

Furthermore, the various Departmental elements are responsible for ensuring that the policy and objectives of the STI Directive are incorporated into their planning and performance measures activities. Field Elements, including the DOE National Laboratories, are also responsible for ensuring that STI products and services funded through their offices are optimally available based on an assessment of the needs of their various customer audiences.

As DOE has made institutional advances in information management, the National Library of Medicine (NLM) has instituted a highly successful planning and functional budget process. NLM's goal is to ensure an integrated approach to life-cycle information management. Under the aegis of the Library's Board of Regents, NLM published a Long-Range Plan to guide the Library into the twenty-first century. More than 100 leaders in

medicine, librarianship, academia, government, and industry participated and contributed their skills and advice to the planning process. The seven-part plan consists of an executive summary, a one-column report with detailed recommendations, and reports of the deliberations and findings of the five panels convened. The panels covered the principal domains of the NLM: building the collection, providing access to the biomedical literature, factual databases, medical information, and supporting health professions education. The experts' advice was distilled into some fifty discrete recommendations; the additional staff and budgetary resources required to implement the recommendations were also included. The Library's Long-Range Plan is a living document and has had great practical benefits for NLM management and program planning. The Plan literally drives the budget. Year by year, NLM is able to track progress. As new opportunities arise, they can be fit into the all encompassing rubrics established in the original plan. Where a topic requires expertise not on the NLM staff, the system provides the framework for acquiring the knowledge through an expert panel and incorporating the result into the overall plan. Since publication of the initial plan, updates have been produced in several new and emerging areas of opportunity: outreach, electronic digital libraries, and training needs of the health services library community.

Another approach to information management planning is implemented by a specific program within the Environmental Protection Agency (EPA). The Environmental Monitoring and Assessment Program (EMAP) is a research effort on the part of the Office of Research and Development. The goal of the Program is to conduct research for the development of "place-based" (large- and small-scale) ecological monitoring and assessment. Resource types monitored are Forests, Estuaries, Surface Waters, Agricultural Lands, and the Great Lakes. In order for EPA to achieve its goal, the Program is (1) conducting research on biological indicators, (2) developing "place-based" monitoring strategies for documenting the condition of ecological resources, and (3) where the agency has a clear mandate—for example, in surface waters—conducting research for the development of a National Lake and Stream Monitoring and Assessment Program.

In accomplishing its mission, EMAP will generate a significant body of STI. STI products currently being produced include databases, datasets, and documents. The stakeholders with an interest in EMAP STI run the gamut from the general public and policymakers to university and government scientists.

In order to meet the objectives of this large and complex Program with its diverse user community, strategic planning for the development and dissemination of STI was clearly required. EMAP developed a five-year Information Management Strategic Plan that presents an information management vision, high-level user requirements, guiding principles, a technical approach, a project management approach, and a high-level implementation plan. This strategic plan was coordinated with planning efforts in other parts of the agency, notably the Office of Information Resources Management. The plan was subjected to a rigorous peer review coordinated by a representative of the National Science Foundation. The plan is currently being successfully implemented by the Program.

B. Collecting Information

Several Federal agencies have a long-standing responsibility to manage scientific and technical report literature. Historically, the Department of Defense's Defense Technical Information Center (DTIC) has collected scientific and technical report literature for the Department of Defense (DoD). As a result of DoD downsizing, however, many traditional sources are producing information at a much lower rate. Consequently, DTIC has adopted a much more aggressive information collection strategy and is investigating nontraditional sources of information and nontraditional formats. In addition, the Center is evaluating commercial document delivery services for their effectiveness and efficiency. Finally, in order to provide access to foreign and domestic information resources, DTIC has developed a strategy to handle copyrighted information. All of these efforts are aimed at identifying and supplying the customer with nontraditional, hard-to-find information "gold nuggets." Such techniques will enable DTIC to play a major role in information resource sharing.

Previously, DTIC converted paper-based reports to microfiche for storage and made them available in either microfiche or paper. Now, the Electronic Document Management System (EDMS) provides the capability to convert from a paper-based manual enterprise for converting hard-copy technical reports to microfiche to a new state-of-the-art system that encompasses a total electronic document management system for document receipt, storage, retrieval, and dissemination. Acquisition efforts for technical reports under the EDMS are focusing first on the receipt of hard-copy reports, which are scanned to create an electronic image, stored on optical platters within optical jukeboxes, and output onto either microfiche or hard copy. Additional capability will be provided to allow for electronic input, thus enhancing the speed of receipt from contributor; providing the capability for full-text retrieval; and enhancing the ease, quality, and magnitude of storage and dissemination. Electronic documents can be accepted on floppy disks, CD-ROMs, or over the Internet. Paper costs and mailings will no longer be required, saving both time and money. The EDMS functions also allow all document management functions within DTIC's document processing pipeline (i.e., cataloging, abstracting, and indexing) to be performed electronically simultaneously, without the physical document, by using an on-line document delivered electronically to the desktop.

DOE has also instituted a highly successful information collection operation. Researchers and program managers want their research results announced as broadly as possible. Traditionally, the Department's Office of Scientific and Technical Information (OSTI) has collected the agency's reports in printed form; however, OSTI is making the transition to collecting and announcing these reports electronically. To facilitate announcement, DOE is working with four sites to provide information needed for the announcement in Standard Generalized Markup Language (SGML) format.

OSTI has a long history of collecting, processing, and disseminating national and international R&D results for use by DOE and its contractors, educators, industry, and the

public. More than half of the over 3 million citations to research results in the Department's Energy Science and Technology database reflect worldwide international research.

The international information collection aspects have been accomplished in increasingly more cost-effective ways through shifting from bilateral agreements to multilateral international agreements in which countries not only share information but also share costs for processing and managing the information. Through these agreements, standardization of exchange formats has been key to limiting the effort required to merge the information into a common database.

As Operating Agent for one of the multilateral agreements, DOE's OSTI serves as the centralized receipt point for information collection. As such, OSTI has first access to the information and makes more than 90 percent of it available to the DOE community within three days of receipt. OSTI has also been able to utilize Internet for receipt of the information directly. More than nine countries currently take advantage of this opportunity to improve timeliness of the information.

Through these international agreements, OSTI is also promoting contacts and partnerships with sources of information, such as publishers. It is hoped that the future will hold even more promise for timely and ready access to the world's R&D results.

Another approach to information collection is provided by the EPA. In addition to traditional survey data, such as that on agricultural production (USDA National Agricultural Statistical Survey), the Environmental Monitoring and Assessment Program (EMAP) collects environmental data (i.e., soil and biological samples). As a collector of environmental data on behalf of EPA and its EMAP partners, EMAP has developed an ISO 9000 type plan, the EMAP Quality Management Plan (QMP). It describes a structured and documented management system providing policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan customized for EMAP processes and the intended uses of its products and services to ensure their quality.

EMAP's quality system components are based upon applications of essential total quality management principles found in guidance prepared by EPA's Quality Assurance Management Staff. This guidance has been developed to address the three major components supporting scientific data integrity. These are (1) Accountability—the assignment of responsibility for all processes in environmental data collection and analysis to obtain adequate documentation confirming adherence to planned schedules and approved protocols; (2) Usefulness—the proper planning starting with the definition of the purpose for which the data are to be used, which provides a context for assessment of the inherent quality associated with data sets; and (3) Inherent Quality—the quality based on the science employed in producing the data (i.e., use of appropriate scientifically based laboratory practices, appropriate quality control and acceptable sampling and analytical techniques), irrespective of its usefulness.

For accountability, EMAP established responsibility and documentation through the structure and processes described by the EMAP QMP and the more specific Quality Assurance Project Plans (QAPP), such as the pilot and demonstration projects of the resource groups and the Regional Environmental Monitoring and Assessments Program. Usefulness is addressed by the development of program-level target Data Quality Objectives (DQOs) and research for EMAP indicators of status and trends. These DQOs, which often apply to compiled indicators representing an entire Federal region, provide a context for development of the Measurement Quality Objectives (MQOs) that serve as criteria for evaluation of data for measurements (both field and laboratory). Inherent quality is addressed by ongoing peer reviews of the program and its projects that evaluate the general approaches used. Also, quality assurance reviews evaluate the implementation of the EMAP QMP and the specific data collection plans (QAPPS) to assure timely corrective action during the project. Data Quality Assessments provide a scientific and statistical evaluation of the data resulting from projects to determine if the data are of the right type, quality, and quantity to support their intended use as planned in the QAPPs or by secondary users.

Access to information on the methods used is needed to test the traceability of the EMAP summary statistics in the data pedigree model and the reproducibility of the methods documenting their derivation. Information on data quality indicators is also needed to estimate the components of error in the extraneous (non-extrapolation) error of the EMAP summary statistics in the data quality useability assessments. EMAP is developing its Information Management System to incorporate an EMAP methods database, taxonomic database, and document database to allow access to scientific metadata including quantitative data quality indicators in QA reports.

In related STI areas, the National Science Foundation (NSF) is implementing a three-year experimental program, referred to as FastLane, that uses advanced information technology to explore methods to redesign and streamline the way NSF does business with the research, education, and related communities. In May 1994, NSF established a FastLane Internal Review Committee to guide the project. The committee is currently describing the NSF internal processing functions, gathering samples of input data, and resolving policy issues. The committee identified 19 potential projects, 6 of which have been selected for pilot applications. The other 13 projects are planned for implementation in 1995 and 1996. Examples of projects selected as pilots include the following:

- Electronic Proposal Forms Submission. An NSF forms server will provide the capability for electronic submission of administrative information related to proposals. The process will provide an automated checklist and edit filters so that submissions are complete and mathematically correct. For people who have previously submitted proposals, a large portion of the required information will be provided by the system. Information could be entered directly or by "cut and paste" from local word processing software.

- **Proposal Status Inquiry.** The NSF proposal status server will allow principal investigators and other authorized individuals to receive the current status of a pending proposal.
- **Announcements of Award Actions.** The NSF server will provide a list of recent awards, including information on the institution, principal investigator, amount, and duration. At a later date, additional information about NSF awards will be made available.

NSF will directly involve a limited number of colleges and universities, representing a cross section of its community, in the design and pilot testing of each application. Project information will also be disseminated widely through the Foundation's normal publications, Science & Technology Information System (STIS), the NSF Home Page, etc., and in presentations and site visits. NSF customer survey instruments and other feedback mechanisms will also solicit feedback on FastLane objectives and plans.

NSF has established working relationships with other Federal agencies that are developing similar systems, including the Department of Energy, the National Institutes of Health, and the Department of Defense. FastLane will be used as a model to ensure the development of systems government-wide that will promote seamless interface between the institutions and the agencies.

C. Implementing Effective Information Dissemination

A primary form of Federal STI is the technical report resulting from Federally funded research. DTIC's Electronic Document Management System (EDMS) provides the capability to make any document instantly accessible. Electronic images will allow new products and services to be developed by combining documents electronically. New profiles could be matched to user requests. Dissemination media such as CD-ROMs could be easily produced according to subject areas, history, or other factors.

With only a modem and a personal computer, people can access vast amounts of information; DTIC provides numerous services and databases that assist users in locating and accessing relevant information. The Defense Gateway Information System (DGIS) is an integrated service providing convenient on-line access to a large number of commercial and government databases. In addition to full Internet access, DGIS provides a Wide Area Information Service (WAIS) capability that lets users search a variety of databases using natural language and/or Boolean strategy.

To improve DGIS, DTIC developed GoldenGate, which includes a graphical user interface. End users are able to search the unclassified portions of the DTIC databases as well as remote commercial databases. GoldenGate uses the DGIS Common Command Language, eliminating the need to learn multiple native command languages. Now, the experienced and the inexperienced users alike can select the most appropriate

databases—commercial, government, or Internet-based; perform a search using an assisted or expert query screen; and read and save the results. GoldenGate includes extensive Help features, including an on-line tutorial to explain its functions and system concepts.

The World Wide Web (WWW or Web), a network of information sites or servers across the Internet, is the fastest-growing Internet application. Through the use of various access mechanisms, or “clients” such as the National Center for Supercomputing Applications’ (NCSA) Mosaic, and appropriate telecommunications protocols, it is possible to access the Web from a variety of platforms, including Windows, Apple Macintosh, and UNIX (X Windows). Web and Mosaic implementations are under way at DTIC for the Office of the Director of Defense Research and Engineering, other Office of the Secretary of Defense (OSD) components, and the Information Analysis Center (IACs). The data are either resident at DTIC or is available through hyperlinks to other sites. Through this initiative, significant amounts of data are collected or accessed through Web/Mosaic products. The intent of Web implementation is to make information available to OSD, the larger DoD community, and, when appropriate, to the public through the Internet. Since the technology is readily available and widely used, the costs of acquiring the capabilities to utilize Web and Mosaic are minimal.

Through the Defense Technical Information Web Home Page (<http://www.dtic.dla.mil/dticw/>), one can access other DTIC Home Pages that provide public access services as well as unclassified information services for which registration is required. A description of DTIC and its services, the Information Analysis Center Directory (with “hot links” to individual IAC home pages), the *DTIC Digest*, and the Small Business Technology Transfer Solicitation are all found on DTIC’s Web. DTIC continues to work with the Office of the Assistant Secretary of Defense for Public Affairs to expand and maintain DoD’s Home Page. The DoD Home Page was designed and implemented for the following reasons:

- To provide a single, unified starting point for public DoD Information on the Internet.
- To provide a coherent and official view of DoD on the World Wide Web and Internet, primarily, by using the existing organization structure of DoD to present existing Internet-based information.
- To provide a World Wide Web interface to the DoD piece of the Government Information Locator Service (GILS).
- To provide information about the organization and functions of the top levels of the DoD, primarily OSD, much of which is currently unavailable on the Internet.
- To serve as an example to other DoD activities for using the Web to provide public information.

The National Agricultural Library (NAL) is the coordinator and primary resource for a nationwide network of state land-grant university libraries, U.S. Department of Agriculture (USDA) field libraries, and other agricultural libraries working together to collect and deliver information to those with an interest in agriculture and its related sciences. NAL has been a leader in national and international collaborative projects in collection development, indexing, cataloging, microfilming, and the use and transfer of technology to share resources and expertise, reduce duplication, and promote greater access to agricultural information. NAL has also been a leader in the use of technology to disseminate and provide electronic access to agricultural information while ensuring that multiple means of obtaining that information are available to its users based on their access capabilities. Examples include the following:

- AGRICOLA (AGRICultural OnLine Access), NAL's bibliographic database with more than 3 million citations to scientific agricultural literature has been the premier source of agricultural information for practitioners, scientists, and researchers within USDA and land-grant universities, and other institutions worldwide since 1970. AGRICOLA is sold through the Department of Commerce's National Technical Information Service (NTIS) and is available on CD-ROM and on-line through commercial information services. Planning is under way to make it available over the Internet through noncommercial sources in 1995.
- ISIS, NAL's On-line Public Access Catalog and automated integrated library collection management system, can be accessed by on-site users and by selected research activities within USDA via remote dial-up access.
- NAL has a gopher server that provides access to each of the NAL Information Centers sub-gopher information menus, NAL publications and resources, and other agriculture-related publications and data. The server links to other agriculture-related gopher systems within and outside of USDA, network information and resources pertaining to the Internet as well as to selected agricultural subjects, agriculture-related information and databases produced by other institutions of interest to the agricultural community. The server also links with many other institutions, such as the Library of Congress and the National Library of Medicine, that can assist the NAL staff in providing information to NAL patrons.
- ALF (Agricultural Library Forum) is NAL's Electronic Bulletin Board System (BBS) that also provides electronic access to NAL products and information about NAL services. ALF contains a vast amount of information of interest to the agricultural community and provides messaging, bulletins, file transfer, and conference capabilities. ALF can be accessed directly via dial-up as well as through FedWorld®, the Department of Commerce's gateway to U.S. Government Bulletin Boards. The ALF BBS equips NAL with a capability to provide access to electronic agricultural information to a range of users regardless of whether they have Internet access.

- CYFERnet (Children, Youth, and Family Education Research Network), is a gopher server established as a collaborative project of the USDA Extension Service and NAL. It provides local communities full-text access to a wide array of information. CYFERnet links with other Federal and state agencies to provide information on youth programs, home economics, and human nutrition programs; to disseminate electronic journals and newsletters; and to provide access to other networks and resources.

NAL has also significantly enhanced its capabilities for electronic information dissemination to support interlibrary borrowing services and electronic document delivery in addition to continuing its mail and fax document delivery operations. The enhancements include on-line ordering from private-sector document delivery services where expeditious delivery is essential and cost-effective. NAL also uses its own electronic document delivery system to transmit and receive scanned page images via the Internet throughout the United States, United Kingdom, Canada, Australia, Hong Kong, and several Scandinavian countries.

NAL and 45 land-grant libraries participated in a cooperative effort to evaluate the feasibility of using optical scanning and optical character recognition to publish CD-ROM discs to provide in-depth access to the literature of agriculture, while at the same time preserving it from rapid deterioration. As a result of the success of the pilot project, in 1992 NAL began an operational CD-ROM production program using state-of-the-art retrieval software. This program is also the focal point for NAL's electronic preservation effort. These discs provide electronic access to important collections of scientific literature pertaining to such subjects as aquaculture, agronomy, acid rain, agent orange, and food irradiation.

Because resource sharing is essential, NAL has long recognized its responsibilities to facilitate access to the electronic information resources of other institutions through the use of networking technology. A number of NAL's information centers have established distributed information networks or serve as the coordinators or focal points for cooperative networks with land-grant universities, private nonprofit groups, agribusiness, and Extension components throughout the country to disseminate electronic information in subject areas of significant interest such as sustainable agriculture, biotechnology, technology transfer, animal welfare, food and nutrition, rural health and development issues, and youth development.

NAL continues to play a key role in using and advocating the use of national and international standards to facilitate access to electronic information. In addition to adhering to bibliographic cataloging standards and standards for information interchange, NAL has been a leader in international efforts to improve worldwide access to agricultural information through an improved thesaurus system. NAL, the Commonwealth Agricultural Bureau International, and the Food and Agricultural Organization of the United Nations are actively working to develop a Unified Agricultural Thesaurus that will reconcile the two major agricultural thesauri presently used throughout the world.

NASA is also implementing new approaches to information dissemination. Access to NASA's RECON (REsearch CONnection) search and retrieval service and ARIN (AeroSpace Research Information Network) library system was made available through the Goddard Space Flight Center Master Directory. This was the STI Office's initial foray into the Internet and was the first time access to ARIN was available outside of the NASA libraries. Also, *SCAN (Selected Current Aerospace Notices)*, an announcement serial, now has an electronic version, *E-SCAN*. *E-SCAN* is delivered biweekly to subscribers via electronic mail. *E-SCAN* is also available through the NASA STI Office's World Wide Web Home Page, via anonymous file transfer protocol (ftp) and by gopher. Electronic dissemination of *E-SCAN* has resulted in a substantial savings in printing costs.

At the National Oceanic and Atmospheric Administration (NOAA), user demands have been growing at a rate of 10 percent a year. After the NOAA Directory was placed on the Internet, usage grew from 1000 requests per year to more than 120,000.

The NOAA Directory, which contains high-level descriptions of NOAA data sets in Directory Interchange Format (DIF), was recently transformed into the NOAA Data Set Catalog. The catalog has an expanded and more flexible search capability (customized searches; distributed searching over a number of systems and formats, including DIF; Boolean searches; availability of several output formats compatible with other systems, e.g., GILS, FGDC spatial metadata standard, etc.). The Catalog currently has more than 5000 NOAA DIF entries, 22,000 general environmental entries (NEDRES) and will accommodate library MARC-format entries in the near future. The DIF entries alone represent more than 220 terabytes of data. There are several access paths to the system—dial-in, telnet, Lynx, and Mosaic.

One shining example of NOAA's information services is NOAA's new Satellite Active Archive (SAA). The SAA system enables users on the Internet to quickly search, browse, order, and receive satellite data. The system includes a Search Results Summary screen, and once results are confirmed, the requester may choose to order the data immediately. The data can be delivered over the network or be mailed to users on various media. The SAA is also a node on the World Wide Web on the Internet.

One pioneer in disseminating information electronically is the National Library of Medicine (NLM), a key player in the Administration's High Performance Computing and Communication's initiative. To help ensure that the health professions are taking full advantage of information on the Internet and the emerging National Information Infrastructure, NLM is encouraging Internet connections and is continually improving information services available to Internet users. Internet users can reach these services through basic Internet processes, such as telnet and ftp, or through software clients such as gophers for gopher servers and Mosaic for World Wide Web servers. File transfer protocol provides a faster and most cost-effective method for NLM and other network libraries to publish and distribute *Clinical Alerts*, *NLM Fact Sheets*, and many publications, such as the National Institute of Health pamphlets on health care and AIDS to

users. In collaboration with the Agency for Health Care Policy and Research, NLM is making available a free, electronic service that provides access to the full text of clinical practice guidelines. Another important tool is the NLM Locator, a client-server interface that allows menu-driven Internet access to NLM's CATLIN (catalogs records of monographs and serials), AVLINE (audiovisuals), and SERLINE (serials owned by NLM and other libraries).

The NSF maintains the Science and Technology Information System (STIS) that includes abstracts for all research awards made since 1989 as well as the *NSF Bulletin*; NSF press releases and tip sheets for the media; the NSF Grant Policy Guide; information on NSF directorates, offices, and programs and specifics about proposal submission; a database of research awards; and the NSF phone directory. Since STIS was activated in early 1991, NSF has expanded its content and audience. Whereas the majority of readers represent science and technology at academic institutions, other readers include the National Association of Science Writers. STIS documents are available by several methods:

- Remote login via modem or Internet. STIS features full-text search and retrieval software (TOPIC) to help users locate the documents and award abstracts that are of interest to them.
- Gopher client software (with an Internet connection). The Internet gopher provides access to NSF information via a series of menus.
- Anonymous ftp. Anonymous ftp allows users to transfer NSF documents to their local systems for browsing and printing.
- NSF electronic mailing lists. These keep users informed of new publications available electronically.
- The World Wide Web. The NSF Home Page on the World Wide Web (<http://www.nsf.gov/>) makes it possible to view text material as well as graphics, video, and sound.

During the last fiscal year, data on STIS were accessed more than 77,000 times. As of December 1994, there have been more than 117,000 accesses to data on the NSF Home Page since it was established on the Web. At least 5 percent of the accesses were from foreign sources. The most popular documents accessed are award abstracts (on STIS), NSF Guide to Programs, Grant Proposal Guide, the *NSF Bulletin* (monthly publication for grantees, et al), and the publication database.

In addition, the NSF's Grants Electronic Bulletin Board provides information to NSF grantees and supports the discussion of issues of concern to grantees. The mailing list for this bulletin board includes many grants offices at institutions receiving grants.

D. Implementing Good Records Management Practices

Because the Electronic Document Management System (EDMS) is providing DTIC with a viable magnetic raster image of the real document, both the integrity of the document and its creator are maintained. DTIC is also creating a silver master microfiche of each document. This archival master serves as an official archival record of the document, provides for a disaster backup, and is used to make diazo duplicates for distribution.

In planning to safeguard the integrity of its scientific data, the Environmental Monitoring and Assessment Program (EMAP) has established logistical procedures for timely preparation, review, approval, issuance, revision, and maintenance of its documents and records. This includes EMAP data files as well as plans, interim reports, and products such as research reports.

EMAP amended the traditional Office of Research and Development guidelines for approval of reports to accommodate its matrix management approach combining centralized program oversight with existing laboratory review. EMAP also developed a centralized electronic bibliography for plans, statistical summaries, and technical reports that become official EPA documents after peer review and clearance. An annual cumulative bibliography is produced from this database as an ongoing index to its published materials. The ultimate goal is to place the EMAP bibliography on-line and make its resources available to users through computer retrieval.

In EMAP, data files that contain measurement and quality assurance or quality control data are considered records and are also subject to control and approval. The specific design and details of the version numbering and the overall controls placed on data files are being developed by the participating resource groups. As data files progress through several levels of review and assessment, they are categorized as raw, verified, or validated. The information management system will be able to produce the pedigree of data, showing the status of the data and the nature of changes to them, including their transition from raw to validated. The information management system will also protect the integrity of the file contents. Information Management has ongoing activities to design, develop, and implement a data directory and catalog as well as a dictionary that will track and document all versions of the data generated and/or managed by EMAP, as well as provide access to external data of required programs.

The approval and acceptance of each category of data files are critical to ensuring that data accepted from suppliers and used in reports or made available to the public meet quality expectations and EMAP mission objectives. Suppliers of EMAP data are required to review the data in accordance with their contracts and agreements. Raw data files are a compiled record of measurement and Quality Assurance/Quality Control (QA/QC) data delivered from the data suppliers. The aggregation and evaluation of suppliers' data files (raw data files) generates a new set of verified data files that must be reviewed, accepted, and approved before being used in validation. In the same manner, validated data files

must also be reviewed, accepted, and approved before being used in reports. Data reports may be required to assemble and document the information needed for these reviews. Publication of results based on these data files will not be allowed until the data files themselves have been approved and accepted.

E. Effectively Providing Information to the Public

Providing information to the nation's health professionals and then ultimately to the public is the National Library of Medicine's mission. NLM's information products and services take advantage of all possible dissemination channels, and the NLM continues to work with the private sector to ensure the widest distribution of its information services. More and more U.S. institutions, companies, and individuals are connecting to the Internet. Therefore, greater emphasis on the Internet, wherever feasible, is clearly the direction in which all should move. NLM is encouraging the development of Internet connection programs and is providing a growing array of Internet-accessible services. NLM is also involved in an aggressive outreach program to ensure that all who need medical information know where and how to obtain it. In response to a growing need for direct access to information on HIV/AIDS by patients and the affected community, NLM initiated in 1994 a policy change that provides cost-free access to NLM's AIDS-related databases.

The National Agricultural Library (NAL), is one of three national libraries of the United States and is the departmental library for the U. S. Department of Agriculture. As the nation's chief resource and service for agricultural information, NAL's mission is to increase the availability and use of current and accurate agricultural information among researchers, educators, policymakers, producers, and consumers of agricultural products, and the public. The Library is the largest agricultural research library in the world and plays a vital role in supporting research, education, and applied agriculture.

The NAL general collection covers all aspects of agriculture, including environmental and natural resources, terrestrial ecosystems, botany, crop production, plant production and protection, forestry, entomology, animal production, veterinary science, aquaculture, agricultural engineering, soil sciences, human nutrition and ecology, farm management, rural sociology, and biotechnology. NAL's extensive serials collection contains more than 27,000 current journals, periodicals, and other serials in 40 languages. NAL's special collections include original manuscripts, archival materials, rare books, photographs, slides, posters, botanical art, oral histories, seed trade catalogs, computer software, audio-visuals, optical disks, translations of foreign language publications, microforms, and other materials.

In addition to providing traditional library reference services, NAL has established 11 specialized information centers to provide in-depth coverage of specific areas of special interest researchers, educators, policymakers, producers and consumers of agricultural

products, and the public. These centers, established in cooperation with other Federal departments and universities, as well as agencies within USDA, include agricultural trade and marketing, alternative farming systems, aquaculture, animal welfare, biotechnology, plant genome, food and nutrition, rural development (including rural health), technology transfer, water quality, and youth development. Staffed with subject area experts, each center provides a range of information services, produces specialized publications of interest to their users, and participates in outreach activities to ensure that the public and its diverse groups of customers are aware of the services and resources available. NAL has also established a customer survey process to ensure that services and resources provided best meet the needs of its customers.

NAL and its information centers assist users in finding answers to specific questions, furnish bibliographies on selected topics, identify current research, assist in performing database searches for information as well as assist and train users in performing their own database searches to retrieve information from the extensive collections of NAL and other information resources. NAL provides information and furnishes requested documents in response to queries received by mail, phone, fax, or electronic mail. Several centers have programs geared directly toward serving the public that does not have electronic access capabilities. For example, a toll-free number has been established to provide information on rural health issues. Users may obtain information on the full range of services and information products that can be obtained through any of these means, including obtaining an automatic response to a simple e-mail request.

NASA has also implemented new initiatives to provide information effectively to the public. The NASA Center for Aerospace Information (CASI) completed a successful WAIS server prototype program to make a portion of the NASA STI Database available to the public. Based on this success, a new project called NASA Select is under way, through which NASA CASI will make available additional selected unclassified and unlimited records from the current databases on a WAIS server. The data will be available through gopher, WAIS clients, and Web browsers, such as Mosaic and Netscape. NASA will further evaluate usage of this service to determine which products are of greatest interest to the user community.

The NASA STI Office has implemented a World Wide Web Home Page to provide easy access to NASA STI services and information about NASA STI products. The NASA STI Office Home Page provides access to electronic versions of SCAN, RECON Select, and the NASA Thesaurus, and telnet links to the NASA RECON search and retrieval service and the ARIN library system. Links to other NASA Internet resources are provided, as are links to general Internet resources.

The mission of the National Technical Information Service is to enhance the U.S. competitive edge. It does this by providing routine access to the information it collects in a variety of formats, as indicated above. NTIS also provides a 30-day rolling window

to the database to the Federal depository libraries through the FedWorld® system, in full compliance of the American Technology Preeminence Act (Public Law 102-245).

NTIS provides access to ongoing Federal R&D efforts through its FEDRIP (Federal Research in Progress) database. The FedWorld® system also provides a single gateway to more than 130 Federal bulletin boards. All of the information in the NTIS database is available to the Federal, state, and local governments, the public and the private libraries.

NTIS products are exempt from Freedom of Information Act (FOIA) requirements. However, NTIS offers its services to other Federal agencies to help them fulfill their FOIA requirements by disseminating the documents they produce. NTIS charges a fee for this service. OMB's 1987 FOIA Fee Schedule and Guidelines reference NTIS as an agency having the requisite statutory fee authority to be exempt from normal fee limits under FOIA.

F. Avoiding Improperly Restrictive Practices

The NLM strives to make its information services and products as widely available as possible to health professionals throughout the nation with minimally restrictive practices. To accomplish this, NLM actively encourages multiple dissemination channels to support access to its databases. For example, NLM supports a nationwide medical library network, and makes its products easily accessible under licensing arrangements to a wide variety of information vendors in the public and private sector, including commercial organizations and universities. At the same time, NLM's statutory authority enables the Library to ensure the public of the integrity of the products and services regardless of the provider. In essence, the NLM policy is that the Library is responsible for ensuring the integrity of its databases even when the database is offered by another public or private data center. Degradation of life-saving, limb-sparing, health-promoting information in any aspect must be prevented so that the public is not inadvertently harmed. Therefore, through license agreements, NLM seeks to ensure that its leased machine-readable data remain as accurate, complete, current, and accessible as those available directly from NLM.

All of the information collected by NTIS is available to the public for a fee, and arrangements can also be made to acquire a license to the full database or a portion of the database in electronic form. Licensing and use fees are charged because NTIS is a self-supporting agency and as such must recover all of its operating costs. NTIS pricing of its products is in full compliance with the statutory requirements and OMB Circular A-130 in that NTIS applies the marginal pricing philosophy to its operation as a whole, rather than product by product.

As a part of DOE's commitment to become more open to the public, a program was initiated and implemented to make available to the public documents which DOE has

declassified and determined to be publicly releasable since October 1, 1994. The Department's Office of Scientific and Technical Information (OSTI) has developed and made accessible a database of references to those documents that is searchable on a WAIS server. The OpenNet database, which provides bibliographic information as well as information on how and where to obtain copies of the documents, is accessible through the DOE World Wide Web Home Page (<http://www.doe.gov>), as well as by telnet ([cupid.osti.gov](telnet://cupid.osti.gov)) or direct dial through a modem. The OpenNet database guides users through documents covering such topics as human radiation experiments, nuclear testing, radiation releases, and historical records of the Department of Energy and its predecessor agencies.

G. Implementing Evaluation and Performance Measurement

Performance measurement and evaluation is a structured, ongoing process at DTIC. To the maximum extent practical, information gathered to evaluate performance against defined measures is a by-product of DTIC operations. Annually, senior managers meet to set/adjust programs based on past performance, current trends, and new or developing technologies and processes. Performance standards, such as response time, percentage of complaints, etc., are set based on the most restrictive technically practical performance. The process for setting standards is being expanded to include the results of benchmarking DTIC processes against the best in business. DTIC is currently benchmarking teleservices, using the results of the National Performance Review (NPR) study as its database of best practices.

Performance data (counts, times) are generated during the production process, either manually or by a computer system that performs some portion of the work. Labor hours and costs are reported as part of the payroll and non-labor accounting system. All the data feed into a unit cost management system that identifies costs associated with each DTIC product and service.

DTIC tracks the time required to deliver a product to a customer, the availability and reliability of its on-line system, and customer satisfaction as measured by customer complaints. These data are also monitored internally at senior management meetings, where performance against goals is discussed. The information is used to help flag operational problems, to document successes, and to improve overall decision-making. The performance measures are documented in DTIC's Strategic Plan and Business Plan.

To facilitate the expanding use of World Wide Web servers, DTIC has drafted a Standards and Guidelines document to provide a minimum set of rules for the design, interface, and structure of Web-based information services at DTIC. In addition to serving as a quality check-list for Web implementors, the document will also provide an introduction to creating a Web-based service at DTIC for new project managers not familiar with all of the issues involved. This document was developed by staff directly involved in

implementing Web-based services at DTIC. These staff considered standards and guidelines from two perspectives: (1) as implementors of Web-based projects and (2) as users of the Internet and the Web.

The group compared other servers on the Web, considering human-interface and technical issues, in order to find examples to follow and examples to avoid. Several meetings were held to discuss the guidelines, and an internal E-mail list was employed so items could be contributed ad hoc. By the fall of 1994, there were several other standards and style guides currently available on the Internet from government, commercial, and academic sources. These were consulted and relevant items addressed.

Several draft versions of the DTIC Web Server Standards and Guidelines document were circulated to interested parties at DTIC in order to ensure that relevant issues were addressed; there were at least five versions drafted over six months. The continuous revision was a direct result of the experience(s) of implementing specific Web-based services; the group realized early that it would take this experience to produce a relevant set of standards and guidelines.

The resulting document does not always provide specific answers, but it does attempt to list the most prominent issues that must be considered. It is expected that periodic changes (especially the result of technical advances) will be required.

H. Management Oversight of Information Systems

The National Library of Medicine's new experience as a Department of Health and Human Services Reinvention Lab is particularly relevant to managing information systems and information technology. Under the National Performance Review, the basic purpose of the reinvention labs is to provide experimental sites where new and improved methods of doing business will demonstrate how empowered employees can reengineer work processes and fully accomplish missions.

As a test site, NLM will be meeting exciting challenges in reengineering its information systems. For thirty years, NLM has been a leader in developing on-line retrieval services, application of computer technology to library services, and advanced R&D in medical information and biomedical computing. NLM is now faced with an array of heavily used, internally developed computer system that perform certain functions efficiently but are ill-suited for effective automated links with newer NLM products and services, and with the increasing number of university, medical center, library, and hospital systems that provide local information support to NLM's primary users. The outmoded systems also require NLM to allocate scarce resources to routine systems maintenance rather than to the development of new and more user-friendly products and services that can be delivered to users through their local systems. As a reinvention lab, NLM is seizing the opportunity to create scalable new systems offering users a range of enhanced capabilities.

In pursuit of the reinvention lab goal, NLM now faces the difficult challenge of upgrading the Library's successful operation with new, current technology systems while preserving and expanding existing products and services. To accomplish this, a single high-level NLM oversight group will direct and coordinate the NLM System Reinvention Project. The oversight group will evaluate plans submitted by working groups involved in upgrade projects, review and approve reasonable milestones, and review resource requirements to assure that adequate resources are provided. The Committee will also coordinate existing system development, especially in regard to further system capability update and transition plans. It will establish priorities within ongoing production systems, and provide guidance and recommend courses of action for the transition of NLM research and development system projects to production status.

To ensure that the new systems support the NLM's mission requirements, the System Reinvention Project has four primary components: the Access Model, Retrieval Systems, File Generation and Maintenance, and Integrated Library Systems. Four working groups have been assigned and will concentrate their expertise in each area.

Central to the System Reinvention Process is the concept of increasing availability of Internet access both for information delivery and to facilitate user surveys and feedback. This customer feedback will help NLM refine its offerings and services and ensure that the new systems meet the information needs of the biomedical community.

As a reinvention lab, NLM will be granted additional authorities, including procurement authorities, that will empower the NLM to reengineer its systems more swiftly and effectively, and to operate as a test site for reinventing government. Eliminating certain internal regulations or increasing procurement thresholds that trigger clearance requirements will reduce the duplicate reviews and approval requirements that slow the procurement process. Even with increased authorities, it is important to recognize that acquisition requirements are not circumvented; rather, their implementation and accountability will be placed with NLM.

I. Acquisition of Information Technology

NTIS is a major information dissemination arm of the Federal government. It acquires scientific, technical, and engineering information produced by other Federal agencies through the implementation of the American Technology Preeminence Act (Public Law 102-245). It also acquires and disseminates STI produced by other sources, including foreign sources, that is of interest to the U.S. industrial and business sectors.

To ensure continued progress as technological advancements impact all aspects of its operations, NTIS has initiated broad modernization plans. A primary goal of the modernization of the entire organization is for everything to work together through a consolidated, computer network. The NTIS modernization initiative that is under way is in

full compliance with the acquisition of information technologies requirements set forth in A-130. In basic terms, the operating philosophy of NTIS is to "invent nothing." Rather than maintain a systems development staff, NTIS takes full advantage of off-the-shelf hardware and software. One of its primary systems, FedWorld®, an on-line information dissemination system, was developed using off-the-shelf hardware and software that is upgraded as the base software platform is updated. Other systems that are built using off-the-shelf software are modified only to the extent necessary to meet government requirements. Thus, NTIS seeks to adapt efficiently what is commercially available and scalable to meet their own requirements.

To determine the type of off-the-shelf technology to apply to a specific function or process, it is valuable to go to the private sector and benchmark. For example, it was important to determine what tools people in the private sector use to fulfill publishing commitments and which inventory management systems are most useful.

The NASA Modernization Project to upgrade its STI Program information infrastructure, funded at \$3 million (so far), will be built with commercial and/or government off-the-shelf software.

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